AUGUST 1964 35 CENTS ICD

SCIENCE DIGEST

DINNER IN 90 SECONDS

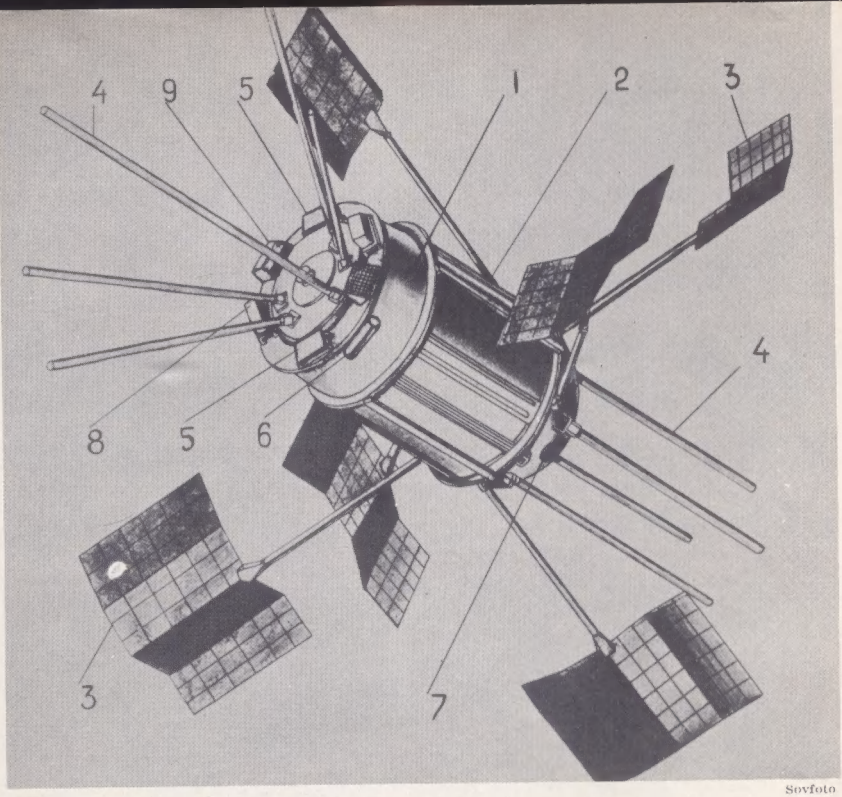
What the food revolution will do to your kitchen

SNAKE HUNT

for science

WHY WE HAVE TWO BRAINS

HOW WE'RE EXPLORING THE OCEANS



Sovfoto

Electron-1 satellite: 1. sealed body of the station, 2. shutter system of heat regulation, 3. solar batteries, 4. antennas, 5. micrometeorite detector, 6. corpuscular radiation registering device, 7. mass spectrometer, 8. proton detector, 9. device for studying the power spectrum of the electrons in the radiation belts.

The Electron 2 satellite had added devices such as: 6. solar orientation sender, 11. device for studying the sun's roentgen rays and 13. charged particle traps.

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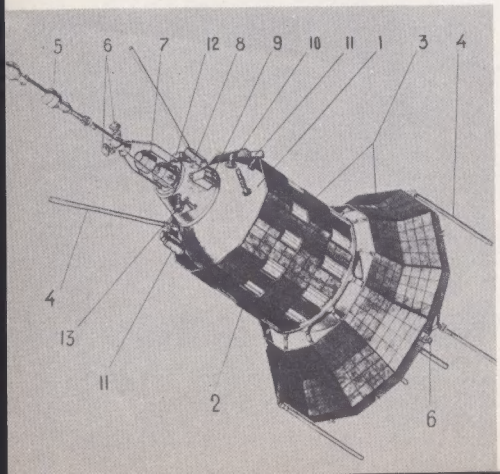

New Red Satellite Details

THE Soviets are notoriously secretive about their satellites. These diagrams of "cosmic stations" launched earlier this year appeared in *Pravda*. This is the first time they have been printed in the U.S. Explanations of the diagrams are not too satisfactory, but they do give a general idea of the design of Russian research satellites.

SCIENCE DIGEST

Twenty-eighth year of publication

Photo George Laycock
With his snake hook in one hand and snake box in the other, herpetologist Rickard F. Dooley steps carefully through the swamp in search of the deadly cottonmouth moccasin. A dramatic photo story of Dooley's strange hunt begins on page 47

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★ ★ ★

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LETTERS

Non-Euclidean geometry

Your article on gravitation ("Gravitation—Science's Big Riddle," May '64) was very interesting and informative, but I would like to make one correction. The four dimensional geometry which Einstein used in his General Theory was developed by Herman Minkowski, not by Riemann, although Riemann did work with non-Euclidean geometry which bears his name today. The two are connected by the General Theory, however, in that Minkowski's four-dimensional space-time turns out to be Riemannian. I would like to see more articles of this caliber in your magazine.

MICHAEL G. SMITH
Rahway, N. J.

When to publish

There are occasions when the decision to publish should be based on considerations other than whether the submitted material meets your usual

standards, and no doubt these are high. Because of them you should have refused space to the article "The Alcoholism Controversy," (May '64).

Every ex-alcoholic who reads it will be convinced that he is a member of that small group which, it seems, may safely return to social drinking. In most instances, as the article implies, he will find himself tragically in error and plunge himself and others again into damage and disaster, this time perhaps beyond the hope of return.

We respectfully pose this question to your editorial conscience: Is social drinking essential to the degree that inviting such heart-breaking risks for anyone is justified?

MRS. EDITH BACKS
Nashville, Ill.

Smoking

No person can ever be sure that he or she will not become a victim of careless smoking whether or not the cigarette is "safe" ("The 'Safe' Cigarette," May '64). Between 3,500 and 4,000 persons, many of them small children, die in cigarette-caused fires every year.

ROLLAND A. SPOFFORD
Pico Rivera, Calif.

I quit smoking seven months ago and I think I have completely changed from the habit of smoking to the habit of chewing gum, but I still long for the soothing effect of nicotine when the going gets rough. Tranquilizers give the same effect but they are even more dangerous.

I'm sure there would be no technical difficulties in producing a stick of gum which would allow the same amount of nicotine to enter the blood stream as can normally be obtained from a cigarette.

E. MARQUIS
RCAF Gypsumville, Man.
Canada

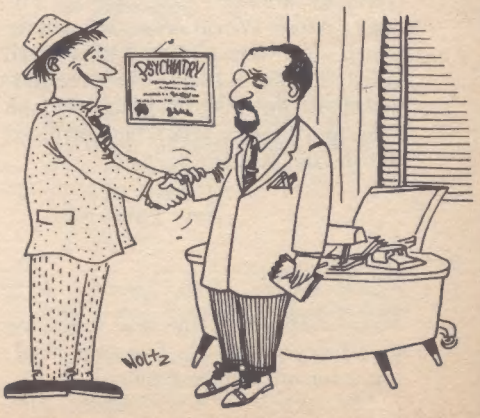
Downgrading the driver

I read your May issue with great interest; however, I disagree with some of the things said in the article "Who Really Wins the Indianapolis." To quote, "The racing car driver is a ball of muscle and courage behind the wheel. But the designers are the real winners at Indianapolis."

Your magazine has gone out on a limb by suggesting that the drivers are uneducated machines doing no more than steering the car around 800 turns, while the genius designers actually control the car. In making this suggestion, although not in so many words, I feel you have downgraded many drivers.

No, you cannot call the driver the designer's robot. I do not say the driver makes all the difference either.

"Thank you, doctor—I feel like a new Napoleon."



I do say, however, the chances of winning are due 50 percent to the driver, 40 percent to the designer and 10 percent to luck.

SIR JEFF "COUNT CRASH" GINGOLD,
Grand Sheref of Monaco
Speedy Playboys of the Western World
Plainfield, N.J.

Katowice again

Your outstanding magazine of science and facts should allow me to correct the facts in one of the letters published in your June '64 issue ("Shifting Borders"). The town of Katowice (Kattowitz) and the Silesia region were built by the Poles and were Polish for almost 1,000 years until 1772 when Prussia, Austria and Russia divided and enslaved Poland.

After World War I, Poland regained her independence and Silesia with Katowice and other western cities, because they were historically, geographically, politically and culturally an integral part of this Slavic nation.

On September 1, 1939, Hitler's Germany attacked and overran Poland. After World War II, during which over ten million Poles were killed, Polish borders were reestablished on the historical lines of the Oder and Nissa rivers which included Silesia and Katowice.

ANTONI GRONOWICZ
New York, N.Y.

The ant and I

Science Digest is the one magazine that I never tire of. I've been reading it for quite some time.

The article, "Bugs About Me" (June '64), by Edna Rehm Payton, sounds like what has always happened to me too.

However, if the author spends the summer flat on her face on the lawn, she can expect an army of ants after her, plenty of flies, probably chiggers, all kinds of hard-shelled insects that inhabit the area under the grass, ticks, worms, gnats, lightning bugs (maybe you call them fireflies), and more mosquitoes!

When the mosquitoes start in on me, I know it's time to quit. They even follow me into the house.

If she is well-blessed with dogs, there'll also be plenty of fleas in the grass. Our neighbors had a lawn-full once and they rode over to ours on pants leg cuffs. Then I was well-blessed, also.

They even got in our beds. I couldn't sleep until I rid the house of them. My husband went on sleeping like a baby—they didn't touch him!

She had better be on the lookout for snakes-in-the-grass. They come right up in our yard.

MRS. RUTH KISSEL
Tennyson, Ind.

Another camp

In your article on science camps ("When Science is Fun," June '64) I would suggest you add another camp, Camp Comet, Route 4, Waynesboro, Pa. The ages of campers are from 7 to 16. This camp was started just a few years ago and is equipped with all types of science apparatus.

The Directors are: Harry Pure, 101 Yellowstone Rd., Plymouth Meeting, Pa., and Morgan Levy, 1531 S.W. 82nd Court, Miami 44, Fla.

LOUIS FRANKEL
Wyncote, Penna.

What do those food labels mean?

by John and Molly Daugherty

MAN used salt to preserve meat before recorded history. Today he uses salt and over 300 other chemicals to preserve and improve food.

Although such a polysyllabic word as monosodium glutamate is part of every food shopper's vocabulary, what do you know about the other chemicals that are added to your food?

1. Which one of these types of chemicals is used for many different purposes in almost every type of food?
   a. Carbonates
   b. Phosphates
   c. Antioxidants

2. Some flavors in foods are oils, which are volatile. They may evaporate. To fix or hold these oil-based flavors, which one of the following may be used?
   a. Gum arabic
   b. Gluten
   c. Glucose

3. A yellowing agent used in bologna, frankfurters, margerine, and other foods is
   a. Crocus pollen
   b. Tumeric acid
   c. Annatto

4. Food flavoring agents, chemicals, essential oils, and spices make up a list of more than 300 food additives. Some are common. Others are little known. Which of these is used for apple flavor?
   a. Caproic acid
   b. Hexanol
   c. Butyric acid

5. Natural food materials are usually more complex than synthetic ones. Some are identical, however, such as fats and simple sugars. Artificial grape flavor contains 5 compounds. How many compounds would you guess are found in natural grape flavor?
   a. 5
   b. 47
   c. 19

6. Some chemical substances are used as firming agents, texturizers, etc., in foods. Which is used to help glaze and polish candy?
   a. Glycerol
   b. Beeswax
   c. Manitol

7. Which one of these additives is an antibiotic used as a food preservative?
   a. Methlycellulose
   b. Lecithin
   c. Chlortetracycline

8. Which one of these chemicals is added to certain foods to inhibit mold?
   a. Boric acid
   b. Sorbic acid
   c. Nitric acid

9. Antioxidants are added to some foods to prevent deterioration from oxygen in the air. Ascorbic acid, identical with vitamin C, is an antioxidant. In which of these foods is it most apt to be used for this purpose?
   a. Milk
   b. Bread
   c. Meat

10. If all the strawberries in the United State were used for strawberry flavoring in our food, how many of us could have the natural flavor?
    a. One in 1,000
    b. One in 10,000
    c. One in 100,000

Answers:

1 - b Phosphates. In this group, phosphoric acid is used in soft drinks. Iron phosphates are used to add nutritional iron to breads and cereals. Orthophosphate salts are used in processed cheese. They are also used in doughs so they'll handle better. Pyrophosphate salts may be used as a stabilizer in low-fat ice cream.

2 - a Gum arabic. This and other vegetable gum additives surround and protect the flavoring agent. The gum dissolves when the food is cooked. Cake mixes and dessert powders contain gum additives to protect the flavor until it's used.

3 - c Annatto. Annatto is a certified coloring agent. Long before chemistry developed safe coloring agents for food, man used carmine from insects, saffron from crocus pollen, and tumeric acid from a root.

4 - b Hexanol. This chemical imparts a synthetic apple flavor. Butyric acid gives a butter flavor. Caproic acid is a cheese flavoring additive. Orange flavor is obtained from cyclohexyl acetate.

5 - c Nineteen. Natural grape flavor is a complex mixture of these compounds. In the natural and the artificial flavors, only two chemical compounds are duplicated. These are ethyl acetate and methyl anthranilate. Although natural grape flavor has been proved safe for centuries, some of its components in pure form and in large quantity are toxic.

6 - b Beeswax. Glycerol is used to keep marshmallows moist and soft.

Manitol is used in chewing gum as an anti-sticking agent.

7 - c Chlortetracycline. It is one of the tetracycline antibiotics food processors use to retard poultry spoilage. Methylcellulose is a food stabilizer and thickener. Lecithin is an emulsifier which enables oil to mix with water and stay mixed.

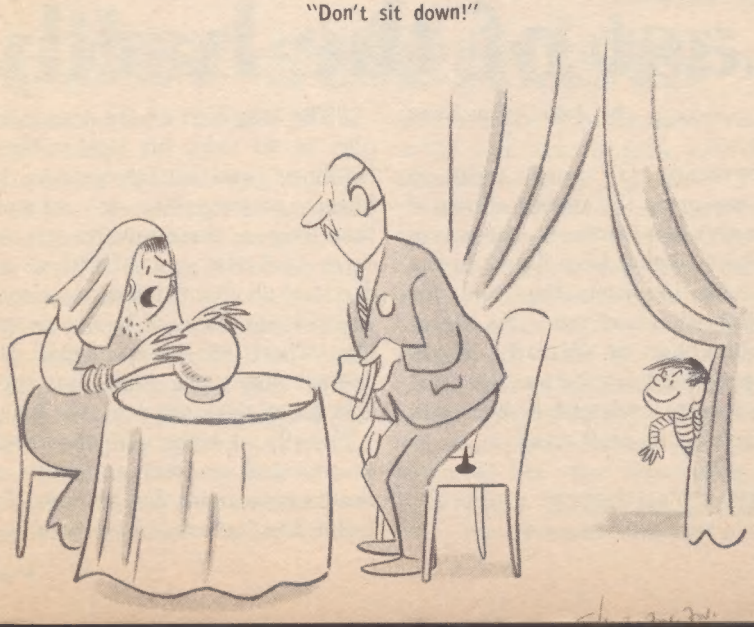
8 - b Sorbic acid. This may be used in chocolate syrup, fresh fruit cocktail, pie filling, and cheesecake to inhibit mold. Food preservatives besides salt that have been used safely for a long time are benzoic acid and sodium benzoate.

9 - c Meat. Another antioxidant used in certain foods containing fats is BHA—butylated hydroxyanisole—in amounts varying from .02 percent in lard to .001 percent in cookies to prevent rancidity. Antioxidants like BHT—butylated hydroxy-toluene—are used in small amounts to protect food. They impart no odor, color, or flavor.

10 - a One in every 1,000. There isn't enough natural strawberry flavor to go around, so chemistry supplies us with an artificial variety. Fortunately, there are many artificial flavors.

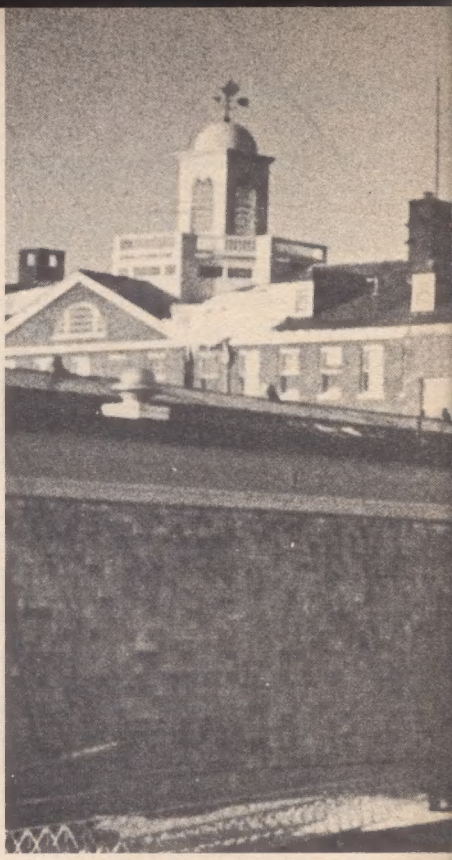
Score yourself:

9 - 10 right—You must be a food chemist.
4 - 7 right—Maybe you're more interested in eating than in knowing what has been added.
0 - 3 right—Read the labels on the cans and boxes on your kitchen shelf more carefully.



With the rapid growth and specialization of oceanography in recent years, Dr. Columbus O'Donnell Iselin has often been called the "last of a hardy breed of oceanographers." These pioneers of a relatively modern science built and sailed their own ships across the seas, performing the dual tasks of scientist and crewmen.

As such, Dr. Iselin is one of the few scientists qualified to act both as senior oceanographer and as captain of his ship.



Last of the hardy

by John Allan Long

COLUMBUS O'Donnell Iselin is exploring the secrets of one of the earth's last frontiers—the ocean. Men have always been drawn to the sea, both in fascination and for transportation and food. As senior oceanographer at Woods Hole Oceanographic Institution, Dr. Iselin strives to understand the ocean and develop its resources.

"The long arm of the oceanographer is his ship, his steel cable is his sinew, and his instruments, his fingers groping into an unknown that covers three-fourths of this earth," he tells you. "Until we understand all about this earth science, we will not have done our proper job. There has been a great deal learned about the ocean, but there is a great deal more to be done."

Equally at home with theoretical or practical matters and with an unassuming relish for activity, Dr. Iselin has been a major force be-

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Christian Science Monitor

sailor-scientists

hind oceanographic research in the United States.

His office reflects his long interest in the sea. A bookcase is crowded with huge volumes of oceanographic data, much of it collected on his many research trips.

A few pamphlets on a conference table describe the institution which he helped found more than three decades ago. On the wall behind his desk is a photograph of *Atlantis I*, Woods Hole's first research vessel which he designed and sailed. The more recent *Atlantis II*, one of the most modern oceanographic vessels in the world, can be seen at its dock from his window.

On this particular day, scientists were making final preparations for an excursion to the cold, tossing waters of the North Atlantic. Only a week earlier, Dr. Iselin had docked *Atlantis II* after leading a three-month tour to the Indian Ocean.

Dr. Iselin, unlike most other oceanographers here, has spent much of his time translating the institution's studies into practical uses. As onetime director of the

institution and now one of its trustees, he is constantly trying to convince its benefactors of the usefulness of the research.

Despite the fact that the United States is not heavily dependent upon the sea for food or wealth, oceanographic institutions have increased in size and number.

The reason is oceanography's historic connection with the Navy. It was the Navy that first brought modern oceanography to its feet in the United States more than 100 years ago and today about half the support for oceanography comes from the Navy.

Other support for oceanographic research, he says, includes about 10 percent from the Atomic Energy Commission and the rest from the United States Bureau of Commercial Fisheries, the United States Weather Bureau, the National Science Foundation, and individuals and organizations concerned with inshore problems.

"The universities have not been traditionally much involved in the science. I am a professor of physical oceanography at Massachusetts Institute of Technology and they do not have a ship or, for meteorology, an airplane. As soon as oceanography becomes practical and people can earn a decent living at it, there will be a demand in the universities for the subject."

"The hardest kind of money to get is that for instrumental development. The reason is that it takes quite a little while to perfect an instrument, and Washington wants results within a year or so. Instrumentation in oceanography remains fairly primitive, particularly in the case of biological instruments.

"All this is not to say that the federal government and private persons are taking a totally mercenary view of oceanography. There are other major benefits being gained from a study of the sea," he says.

"The old idea was that the sea was good for nothing except transportation and defense, but the smaller countries . . . are beginning to prospect for oil in the North Sea . . . and mine diamonds off the coast of South Africa.

"It is the job of a laboratory like this and people like me to always be 20 years ahead, and so I have been wondering how to start farming the ocean.

Oceanography, indeed, is entering a new world, in which the wisdom of the statesman will play as significant a role as the research of the scientist. Like other leading oceanographers in the United States, Dr. Iselin is vitally concerned with this new emphasis.

"The United States has a gold-mining ship off Alaska. Suppose the Russians build a gold-mining ship and come into those waters, what are we going to do about it? These problems are arising to be settled at the State Department level.

"When sitting around the table at the United Nations . . . we must see that the sharing is done in a reasonable and fair manner. And we must see that conservation in the broadest sense is practiced."

5 coming breakthroughs in oceanography

by Columbus O'Donnell Iselin

IN THE years since oceanography became fashionable, the press has repeatedly stated that we know practically nothing about the ocean. That is really not so, as anybody could quickly learn by spending some time in a good scientific library.

Much patient work has been necessary to prepare for a real mastery of the subject. The prospects now seem bright that such understanding will develop rather quickly, perhaps within the next 20 years, since much of the essential groundwork is close to completion.

I shall sketch here, some of the points at which breakthroughs may be expected.

1. The rate at which the ocean as a whole turns over determines its biological productivity. The ocean is a vast chemical sump which contains all the nutrient chemicals (chiefly phosphates and nitrates) that have washed off the land since the beginning of time. These are available for plant production only when they are within about 100 meters of the surface, where sufficient sunlight is present. As the plants grow they are eaten by animals which in turn die or are eaten by other animals. Thus the chemicals essential to photosynthetic activity are continually being drained downward, in the bodies of sinking animals from the well-illuminated surface layer.

Nutriently rich waters are returned to the surface layer by a number of processes, but only periodically or in restricted areas. It is chiefly the winds that "plow" the ocean, and at present they are not quite strong enough to maintain maximum productivity. To determine the rate at which the ocean as a whole turns over under present climatic conditions is one of the major objectives of modern oceanography.

A major assault on this problem was organized during the International Geophysical Year (1957-58). One practical objective was to find out how much high-level radioactive waste material could safely be deposited in the deep parts of the ocean. How soon would this be returned to the sunlit surface layer and thus become incorporated into plants and then into animals that might be eaten by man? Obviously turbulence and currents will dis-

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Two thirds of this earth is unowned by any person or country—it is the ocean. It represents vast resources and wealth to be developed.

purse the toxic material, and the volume of the ocean is huge. On the other hand, biological activity will reconcentrate the material. Radioactive strontium, for example, will mostly end up in the bones of fish. How soon will sardines become dangerous to eat? The threat is certainly not immediate; nevertheless it is desirable to know whether we are talking about 1,000 years or several times that long. We have already destroyed or used up much of the resources of the land. We should not, from ignorance or heedlessness, do the same thing to the sea.

2. Another basic area is air-sea interaction. The atmosphere and the hydrosphere together constitute a huge and complex heat engine. To some degree the ocean acts as the flywheel on this engine. Over what range of time does the ocean regulate our weather and climate? If we knew, we could make much more accurate long-range weather forecasts. Thanks to the large computers, this no longer seems a dream.

3. To an oceanographer the simple question "Where am I?" is most important. Most of what we know about circulation of the ocean has stemmed from improvements in navigation. Until the chronometer was perfected, currents could not be detected in the absence of landmarks. Excellent radio navigational techniques, coupled with atomic clocks, promise soon to supply world-wide precise navigation. Satellite navigation will also soon be available.

4. Underwater acoustics is another rapidly developing field. Sound is the one form that travels well in water, and we should soon be able to make large areas of the ocean acoustically "transparent." By such means biological oceanography can be put on a quantitative basis. It will then no longer be necessary to guess how many fish were smart enough to escape the net.

5. Thinking about the future control of marine resources one comes face to face with the peculiar legal status of the ocean that has developed slowly over the years. Nobody claims to own or to govern this watery two-thirds of the earth's surface, and even its vast resources, beyond the three- or twelve-mile limit, are considered common property.

As long as the open ocean was thought of only as providing cheap transportation and a measure of defense, this legal vagueness was perhaps justified. Fisheries did expand out from the shoreline, but there was at first plenty to be caught by anyone hardy enough to venture away from the land. However, about 1900 scientists and fisheries ad-

ministrators, mainly in northern European countries, began to worry about a possible over-fishing problem. Their concern was of course centered on the North Sea, which is indeed a heavily fished area, but less than .5 percent of the whole ocean. The International Council for the Exploration of the Sea was established with headquarters in Copenhagen. Its purpose was to cooperate in studies and field problems so as jointly to assemble some facts that could form the basis of sensible conservation measures.

As it turned out, fish insure their survival by an enormous fecundity, and it is usually economics rather than lack of science that automatically regulates the catch. With few exceptions, fishermen stop harvesting a given species long before the stock has been exhausted.

A changing industry

However, today the whole fishing industry is changing rapidly. Factory ships have appeared. Nations that formerly fished only in home waters are now sending fleets all over the world. Problems are perhaps arising that custom and international law will be hard pressed to meet.

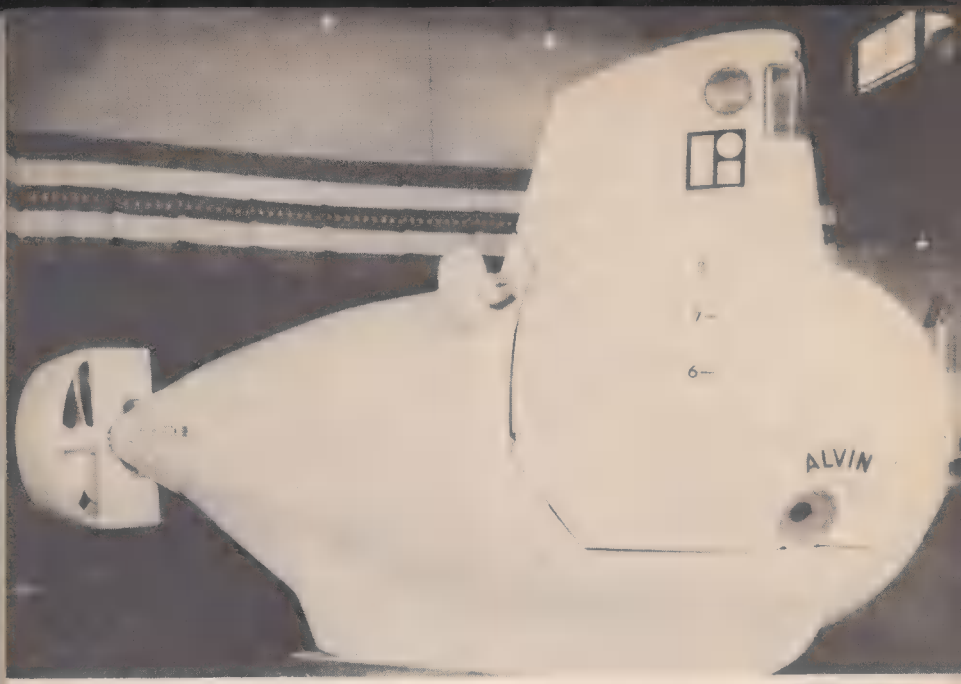
The fact remains that most fish still have more to fear from their natural enemies than from man. Even though the world catch has recently been doubling about every five to seven years, the total (now about 45,000,000 tons annually) is still pitifully small in view of the natural productivity of the sea.

Even today fishermen are hunters rather than farmers and for the most part not very efficient hunters. As hunters, they are basically individualists, and the industry, until very recently, has had hardly any engineering support. Nothing exists comparable to agricultural experiment stations, nothing comparable to the farm machinery industry.

There are signs, though, that in the major maritime nations the industry may soon become more progressive. If the price of fish goes down sufficiently, and especially if the costs of preservation and distribution can be reduced, many more people will be able to afford this excellent form of protein.

The biological potential of the ocean is by no means its greatest resource. The ocean is the fount of all our fresh water. If we could help it to produce more and to distribute this more evenly, we could leave the fish in peace for many generations to come. Oceanography also knows quite a bit about this topic and is exploring some promising leads. A measure of climate control and modification is scientifically just around the corner. Again the trouble is that government officials and international lawyers are unprepared to help make a sensible distribution of the almost endless bounties of nature.

Science, although somewhat slow and cautious, is proceeding with its job. It gets almost no support and guidance on the social problems into which we are blundering.



Litton Industries

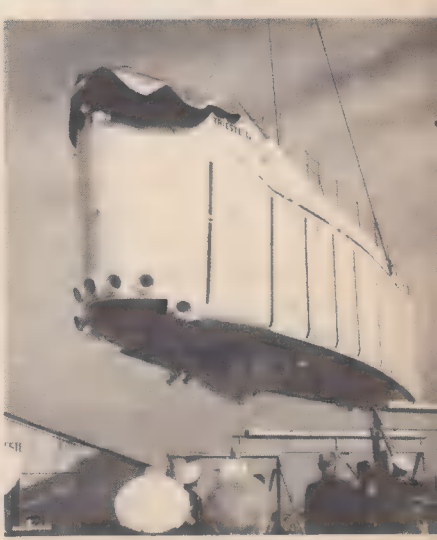
The Alvin, built for Woods Hole Oceanographic Institute, is 22 feet long, weighs 13 tons.

New 'inner space' ships

THE boom in oceanography has stimulated the construction and design of undersea research vessels of all shapes and sizes.

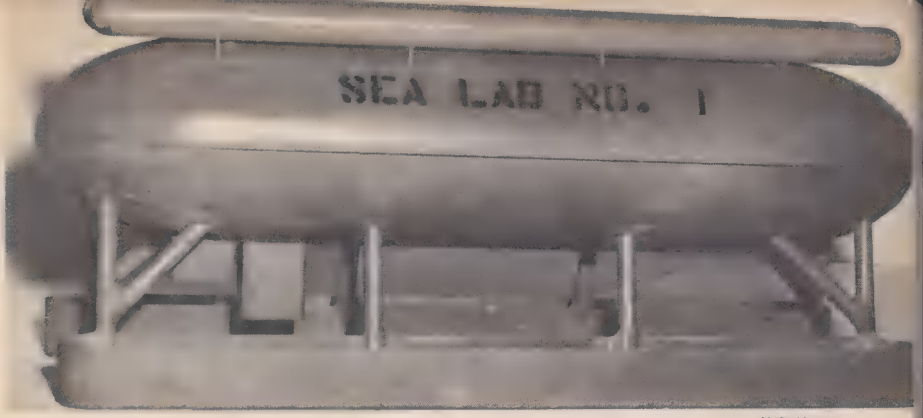
The *Alvin* (above) looks deceptively like a conventional submarine. But the shape is for streamlining and control only. This outside hull fills with water when the craft is submerged. Inside this hull is the real protection for the crew—a seven-foot sphere with thick steel walls, which allows the *Alvin* to withstand water pressure down to 6,000 feet.

The most famous of underwater vessels, the bathyscaph *Trieste*, has been replaced by an advanced Model, *Trieste II* (right). Other craft are shown on the opposite page.



U.S. Navy

Bathyscaph Trieste II is being used in the Navy's search for the sunken Thresher.

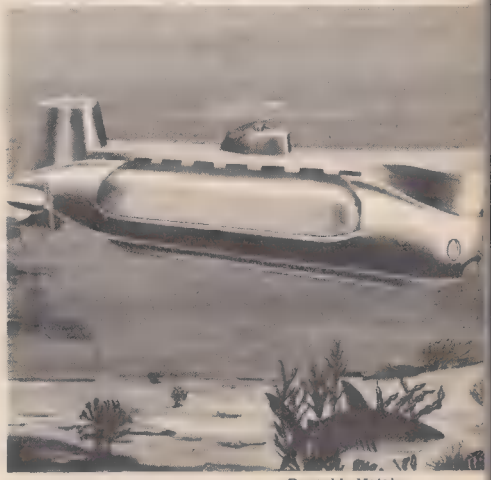


U.S. Navy

Not a movable craft, but an experimental underwater house, the Navy's sea lab will allow four men to live and work continuously at a depth of 192 feet for about four weeks.

Lockheed

Turtle is a small self-propelled underwater saucer. It is designed for work at moderate depths, and might be used to repair cables and follow migrations of fish.

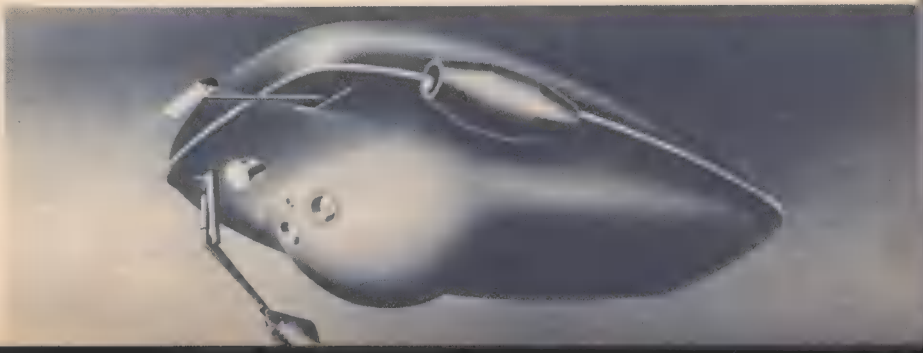


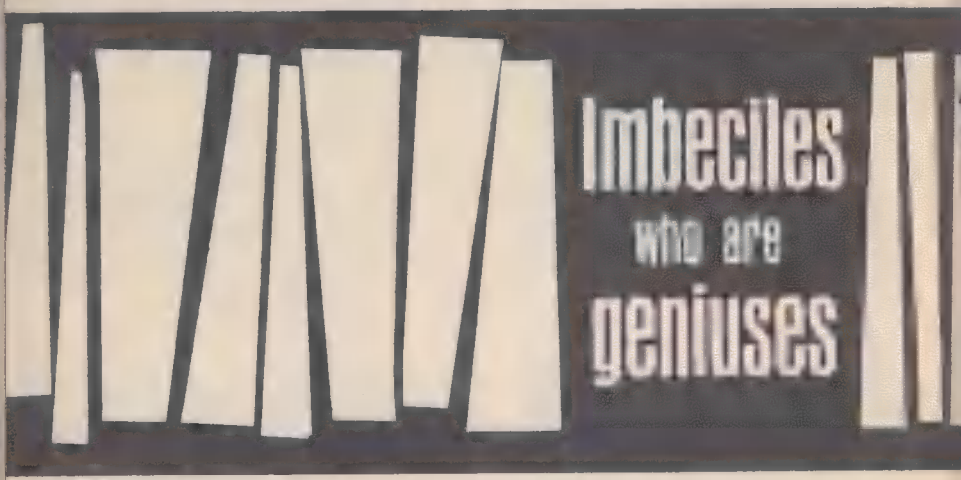
Reynolds Metals

The largest of the new submarines is Aluminaut, will be 50 feet long and made mostly of aluminum. It should take three men three miles down for three days.

Like Alvin, Deepstar will have a streamlined outside covering a heavy pressure sphere. It will have a giant claw for grasping things and an intended depth of 12,000 feet.

Westinghouse





by Bette Greene

On the stage of the Columbia University Medical School Auditorium, stood a boy of nineteen blandly answering the questions put to him by some of the more than two hundred physicians in the audience.

"Percy, could you tell me the day of the week that June 29, 1934, fell on?" asked a silver-haired doctor in the third row.

"Friday," replied Percy without hesitation.

The aging doctor nodded in agreement, for he remembered the day well. It was the day his daughter was born.

"What about April 18, 1929?" asked a heavy-set doctor with a Boston accent.

"Thursday," said Percy as he examined a small scab on his forearm.

"He's right again," said the Boston accent.

From the back of the room, an elderly doctor rose.

"Do you think Percy could answer one from the nineteenth century? What about April 9, 1867?"

"Tuesday."

"January 17, 1601," called out a voice.

Less than an eight-second pause and the boy said Wednesday. Almost a full minute later, a man on stage with a mass of calendars called out to the audience, "January 17, 1601—Wednesday."

The doctors were impressed. Still more dates from the sixteenth to the twenty-first century were thrown at Percy and with the same nonchalance, he correctly called them all.

The chief pediatric neurologist at Columbia, Dr. Sidney Carter, walked to the stage.

"Percy, that was very good, but I was wondering if you would tell the doctors just how you do it." Percy looked vacantly at Dr. Carter.

They're called idiot savants—mental deficients who perform incredible feats of mental wizardry. Science believes certain highly developed groups of neurons give them their super brain power, but it's not sure how.

"Tell me how you know what day these dates fall on," persisted Dr. Carter. Percy continued staring at the doctor.

". . . What we would like to know, Percy, is what is your method?"

Finally the boy responded, "What does it mean, method, doctor?"

Percy was not being coy or difficult or even "cute." He is what is known as an idiot savant. His I.Q. has been recorded at 58.

Idiot savants are an exceptionally rare species of mental defectives who have a phenomenal talent or aptitude, not merely compared to other mental defectives, but compared to some of the brightest members of our society.

This talent might be in calendar calculating, mathematics, drawing, music rhyming, memorizing trivia, mechanics or the development to an unbelievable degree of one of the special senses such as the sense of smell or hearing or sight or touch.

It must be kept in mind that the idiot savant, like all mental defectives, is incapable of living in the outside world and needs the controls and supervision of a protective environment.

The English physician A. F. Tredgold, who has spent his life studying mental deficiency, believes that the special talents are brought about by "an increased development of certain groups of neurons (nerve cells), but as to how this is brought about we can only conjecture. . . . The talent, whatever it is, and however originating, certainly owes much of its development to constant exercise."

The idiot savant is totally incapable of understanding his knowledge. One idiot savant who, like Percy, is an avid calendar calculator, could figure immediately upon being given the dates of birth that his grey-haired doctor was born on a Saturday and the undersized

So grotesque was the imbecile Gottfried that the children jeered him in the streets. Yet his painting graced a royal palace.

schoolboy who was brought into the examining room was a Thursday baby. Yet he could not decide whether the doctor or the schoolboy was older. Making this kind of discrimination called for at least a primitive ability at abstraction which idiot savants seem to lack.

Still another boy idiot savant, after performing enough remarkable mathematical feats, demonstrated his inability to make a simple abstract judgment. A magician began pulling eggs out of the boy's ears and white rabbits from his pockets, but this eleven-year-old could not have cared less. It did not occur to him that eggs and rabbits were not usually found in either ears or pockets. What causes things to happen was too abstract for him to comprehend.

Never idiots, never wise

Actually, the term "idiot savant" is incorrect. Such people are almost never idiots, the lowest rung on the mental defective's ladder, and despite a dazzling skill they are never, never savants, meaning wise.

The idiot savant is usually an imbecile, the medium grade of mental deficiency, or sometimes even a moron, the highest level of mental deficiency. The imbecile can be taught to protect himself against most everyday dangers. An imbecile would not stick his hand into a bonfire to retrieve a fallen marshmallow. An idiot might. But even the moron's defect is still so profound that he requires control for his own protection as well as for the protection of others.

One of the very few cases on record of a female idiot savant (for some unknown reason the idiot savant is almost invariably a male) was described by Dr. A. Wizel. Little yellow-haired Sabine developed normally, even quickly, and at six she began school. But a few short months after she began school she came down with a severe typhoid infection. During convalescence she developed violent convulsions. This was followed by long periods of unconsciousness. When she finally regained consciousness, her brain had become severely and irreparably damaged. She was now totally blind, mute and completely changed mentally.

After many weeks, Sabine recovered her sight and her speech, but her intellect was still hopelessly impaired. She was diagnosed as imbecile.

To direct questions, she developed

a compulsion to reply in rhyme. Sometimes Sabine's rhymed responses made sense and at other times they were just a collection of nonsensical words that happened to rhyme. When her mother, for example, asked, "Sabine, what would you like to have for lunch?" she responded,

"Oh, for lunch, lunch, lunch
I'll just munch, munch, munch."

"Would you like this piece of ham?" queried the mother patiently.

"Ham, Lam, Jammy, Tam, Bam!"

When Sabine was about thirteen, she began sorting and resorting her collection of buttons and coins. She could not even be taught to dress herself or to tell the time, and her family assumed that her interest in these objects was on an infantile level. One day the father asked his wife within earshot of their retarded daughter how many buttons and coins she had. Instantly Sabine replied, "6 x 16 plus eight more."

Instant square roots

The incredulous family found that Sabine was also able to immediately and accurately handle square roots, add, subtract and divide. When asked to multiply 23 x 23, she answered without hesitation that the answer is 529 which is the same, she volunteered, as 12 x 44 plus 1.

Some imbeciles have been known to reel off cantos of poetry verbatim.

Dr. Martin W. Barr described a twenty-two-year-old epileptic idiot who had "the gift of tongues." After many years of the most careful teaching, he was unable to master the rudiments of reading, writing or arithmetic. Still he possessed the most amazing ability to reproduce the spoken word. Fluently and with proper intonation, he could repeat lengthy passages spoken to him in Greek, Japanese or Danish.

"The cats' Raphael"

At Berne, Switzerland in 1768, an imbecile named Gottfried Mind was born. So grotesque was Gottfried that the brave children of Berne would jeer at him in the streets while the more fearful ones would run screaming home to their mothers. So retarded was Gottfried that he could not learn to read, write or handle money. But he had such a sensitive ability to draw children and small animals (especially cats) that he soon acquired a reputation that spread throughout Europe and he became known as "The Cats' Raphael." Hearing about this great Swiss artist, King George IV of England arranged for a private showing and purchased one of Gottfried's water colors of a mother cat with her kittens for the royal palace.

Psychologists have pointed out that some imbeciles and even idiots have developed a bloodhound's sense of smell while still others have an exquisite sense of taste. One blind idiot could distinguish his clothes from all others by his super developed sense of smell. And still another idiot could make a great chef

"The Genius of Earleswood Asylum" was successful in all his inventions until he tried to guillotine the new hospital steward.

feel that he had a crude set of taste buds. This severely retarded boy refused to finish a cup of strong black coffee, his favorite beverage, because one drop of wine had been secretly added to further test his sense of taste.

There was once a blind young institution patient named Fleury who could give the square root of any number of four figures in approximately four seconds and the cube root of any number of six figures in six seconds. When asked how many grains of corn there would be in any one of 64 boxes with one grain in the first box, two grains in the second box, four grains in the third box, eight grains in the fourth box, and so on, Fleury gave the answers for the fourteenth box (8,192) for the eighteenth (131,072) and the twenty-fourth box (8,388,608) instantaneously.

Sixty-four boxes in seconds

It took Fleury only six seconds to calculate that the forty-eighth box had 140,737,488,355,328. In forty-five seconds, he correctly calculated that the total grains of corn in all sixty-four boxes were 18,466,734,073,709,551,615.

Then there is the celebrated J. H. Pullen, "the Genius of Earleswood Asylum," born in England in the year 1835. He did not begin to speak until he was seven and then only the word "Muvver." And for the rest of his life his speech remained for the most part nonintelligible. To boot he was exceedingly deaf. As a boy, he showed an early ability to draw, but he spent most of his day carving little ships out of pieces of firewood.

When J. H. was fifteen, he was admitted to Earleswood Asylum for the retarded where he was put to work in the carpenter's shop. He soon acquired a reputation as a craftsman *extraordinaire* . . . a reputation that was exceeded only by his growing egotism. While showing visitors his handiwork, J. H. would frequently stop to pat his own head and remark, "Very clever." Egotism is exceedingly rare in an idiot savant because they rarely ever recognize their own super ability.

Among the vast quantity of things that J. H. designed and built over the years were intricate and beautifully executed bookcases, desks, chairs, tables, work benches, ornate picture frames and many other things.

But his "magnum opus" was the ten-foot-long, 18⅝-inch-wide model

of a steamship which he named the *Great Eastern*. When the *Great Eastern* was shown at the Fisheries Exhibition in 1883, it was the hit of the show.

Three-year masterpiece

It took J. H. Pullen three years and three months to complete. Every detail, including brass anchors, ropes, pulley-blocks and copper paddles, was actually made by him from careful drawings that he had made beforehand. The planks of the leviathan are fixed to the ribs by a million and a quarter wooden pins. These pins were made by Pullen in a machine that he also devised and planned.

On the *Great Eastern* are thirteen lifeboats hoisted on complete davits, each of which is a perfectly finished model. A pulley system was devised by which the entire upper deck is raised to show the state cabins below. Each cabin is completely furnished with bunks, chairs and tables made exactly to scale.

Pullen failed only once in being completely successful in his inventions. He developed a violent hatred towards a new hospital steward and methodically contrived to "do him in." After many days of careful planning and work, he devised a Rube Goldberg-like guillotine and placed it over the doorway. But luckily for the shaken steward, either he went through the door with more than usual speed or Pullen's instrument was set a split second too slow.

J. H. Pullen died at Earleswood on May 31, 1916 at the age of 81. The autopsy showed a small brain with an ape-like simplicity of the convolutional pattern. This stands as a strange and paradoxical contrast to the designer and builder of the *Great Eastern*.

Cool cats and happy cats

There are all kinds of cats; there are black, brown, yellow, white, and calico cats. There are aristocrats of the feline world, and there are alley cats. There are regressed cats and there are social climber cats. Dr. Paul Layhausen of West Germany's Max Planck Institute has studied all kinds to find out what makes a cat purr. A cat's purr is like a human being's smile, he found. It usually means they're happy or friendly—but there can be other reasons. It can be the sign of a crazy, mixed up cat. A grown-up cat that purrs may be playing at being a kitten. "Regression," Dr. Layhausen labels it.

Then there are the status seekers. A cat who is hip enough to curry the favor of a high class cat will use the snob or diplomatic purr. A real aristocrat may show he's not such a bad guy by using a democratic purr. A tomcat might use this bit with a goodlooking lady cat. But, Dr. Layhausen says that cat owners shouldn't worry even though their cat purrs. In most cases it's pure friendship.

Inventor of the month

Mechanical brain quotes stock levels

Emik Alexander Avakian's works find application from the stock market to surgery.

EMIK Alexander Avakian might be called Handicapped Inventor of the Month. A federal committee chose him Handicapped American of 1961, and awarded him the President's Trophy.

Despite almost total physical disability, Emik Avakian carries on an active professional life. His title at the plant of the Teleregister Corporation in Stamford, Conn., is manager of man-machine interface development. The interface is where the human brain meets its mechanical counterpart.

Recently Avakian and Robert J. Buegler, manager of systems applications for Teleregister, were granted Patent 3,133,268 for what is called, in formal patent language, a Revisable Data Storage and Rapid Answer Back System. A practical use of the invention came in the same week, as the American Stock Exchange inaugurated Am-Quote, a talking computer service.

When a broker dials the code number of a stock, Am-Quote gives him orally the ticker symbol, bid, asked, last sale, net change from the previous close, volume to the moment, and open, high and low prices.

Am-Quote was being connected to 550 brokerage telephones in the New York area. Avakian was also one of many engineers who worked on Telequote III, a new national service that gives video reports on a small desk screen, instead of talking.

He has another patent pending on a Scanning Irradiator, a surgical tool that uses a laser for making lesions in the brain—an extension of bloodless surgery.

The remarkable Emik Avakian (pronounced a-Vackian) was born of Armenian parents in Teheran 40 years ago. They brought him to America as a boy, in search of relief for his cerebral palsy. He has spent his life in a wheel chair, but his mind knows no handicap. Last year Iran presented him with its Order of the Crown.

Although he speaks slowly and with apparent difficulty, Avakian says he likes to talk, and often addresses technical meetings. He has the limited use of his legs, and can propel his wheel chair slowly backward. His

arms, hands and fingers are useless. On business days he commutes by car to Stamford from his home in Tuckahoe, N.Y.

Before he joined the Teleregister staff, Avakian developed a random access microfilm storage system. Its shop nickname is CRIS (for Command Retrieval Information System). It has been licensed to a Washington company.

At the Stamford plant he has successfully followed his specialty, which is getting information into and out of electronic data processors.

—Stacy V. Jones

INVENTIONS PATENTS PROCESSES

Citywide traffic cop

A LOT of westbound traffic, and almost no cars going north or south? Change the traffic lights. Are cars blocking one route into the city, when they could be making good time on another? Why not tell the drivers so? The first computer-operated traffic system to adapt itself to actual present traffic conditions can do this sort of thing.

The system, known as ROTRAC, automatically adjusts the light color changes according to conditions. All the units involved in the system, from traffic lights to computers, are made by Elliott Traffic Automation Ltd., Elstree Way, Borehamwood, Hertfordshire, England.

ROTRAC uses a basic closed-loop cycle from traffic detectors to computer and back via local controllers to traffic signals. It can also have such refinements as closed circuit television, direct links with emergency services and links with parking lots. In larger installations, a central control room is essential.

Detectors to measure traffic flow can be contact pressure pads, buried hydraulic sensors, photo-electric cells, magnetic loops, infra-red or ultrasonic units. Surveyance radar can also be used to supply data.

Pulses from the detectors are transmitted along a communications network and fed into the computer with the aid of a frequency division multiple or digital supervisory system. Counting registers receive pulses, representing volume densities and speeds of traffic. These are compared by the data processor with the stored information on fixed parameters, such as the physical dimen-

sions of streets and intersections, the number of lanes and the precentage of crossturns. Flow tendencies in certain street sections are also compared.

The data processing can adjust to an infinite variety of traffic demands. It can also retain information from its own experience so that on the basis of information gained from the control of a few intersections it can control an entire city area.

Traffic orders are routed through the communications network to local controllers. Local controllers keep information flow to the traffic signals at a minimum.

In addition to passing on the commands to drivers by traffic lights, displays can be activated to show drivers the quickest or alternative routes, availability of parking, and optimum speeds for uninterrupted travel.

11-minute boat

Take an extruded single sheet of plastic ⅜ inches thick, heat it in an oven for about five minutes at 425°F, take it out of the oven and vacuum-form it into a boat hull in a matter of seconds. Let the hull cool for another five minutes, remove it from the vacuum-forming line, trim the excess off the edges, and install the seats and other hardware. Time—11 minutes!

That's the recipe Lancaster Boat Co., 5451 West 104 St., Los Angeles, Calif., uses to produce a lightweight boat of Ameripol high-density polyethylene plastic. Ameripol is the product of Goodrich-Gulf Chemicals, Inc., Cleveland. Although smaller craft have been made of polyethylene before, Lancaster says this is the first use of polyethylene in the construction of a popular-

One-piece polyethylene boat is off the production line in only 11 minutes time, including hand trimming (below). Built-in paint job helps minimize upkeep on this handy boat.

sized craft suitable for fishermen, duck hunters, and family boating and camping enthusiasts. The boat is about ⅓ the weight of comparable fiberglass models, and can easily be loaded on a car roof for transporting.

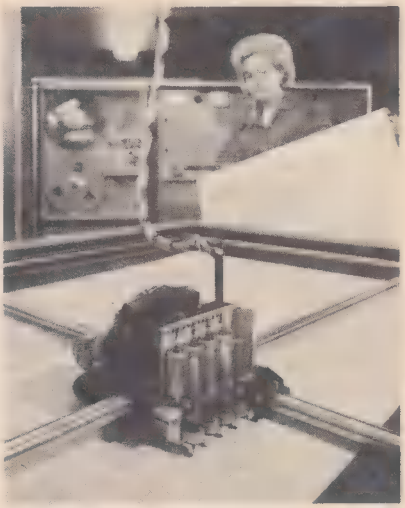
The boat comes in white, bronze and green in a simulated lapstrake design. The solid, one-piece hull will not rot, corrode, chip or peel. It will not sink even if filled with water. Since the color runs all the way through the material, re-painting is never necessary. In addition to the pigment used for coloring the sheet, an ultraviolet filter is incorporated into the polyethylene at the time the sheet is extruded. The filter and color provide protection against the deteriorating effects of sunlight.

Electronic draftsman

An electronic drafting machine that can accomplish in hours what it might take a draftsman days or weeks to do has been developed by Hughes Aircraft Co., Culver City, Calif.

The machine converts engineering data stored on computer tape into finished drawings, wiring schematics, PERT time-phased networks and even street maps.

PERT networks are complex charts widely used by industry for keeping track of schedules and progress of large projects. Industry is often hampered by the slowness of ordinary drafting methods, sometimes to the extent that a PERT chart is already obsolete by the time a draftsman has completed it.



An automatic drafting machine now enables industry to eliminate the time consuming task of human draftsmen.

ADMA, short for Automatic Drafting Machine, draws circles, arcs, ellipses, straight and diagonal lines, and can turn an engineer's hurriedly scribbled design into a ready-to-use drawing of superior quality, according to Hughes' guidance and controls division.

In developing ADMA, a code that would permit the translation of an engineer's sketch into computer language had to be set up. The engineer's sketch is used as the basic input. A human encoder translates the sketch into computer logic by assigning numbers to symbols, junctions, and terminals. This information is then placed on punch cards which are used to prepare the final ADMA drawing tape.

A permanent symbol library was

set up consisting of a magnetic tape record of commonly used schematic symbols. This eliminated the need to design and encode components of a symbol each time it is required. A single computer command can call up the standardized symbols for entire sections of drawings as needed.

The heart of the ADMA system is the program electronics and a 30 by 30-inch X-Y plotter which positions a printing and inking mechanism. Controlling the plotter and its pens and printer is a digital tape and analog signal control converter which may be nearby or at a remote location—even in a distant plant.

Rugged little plane

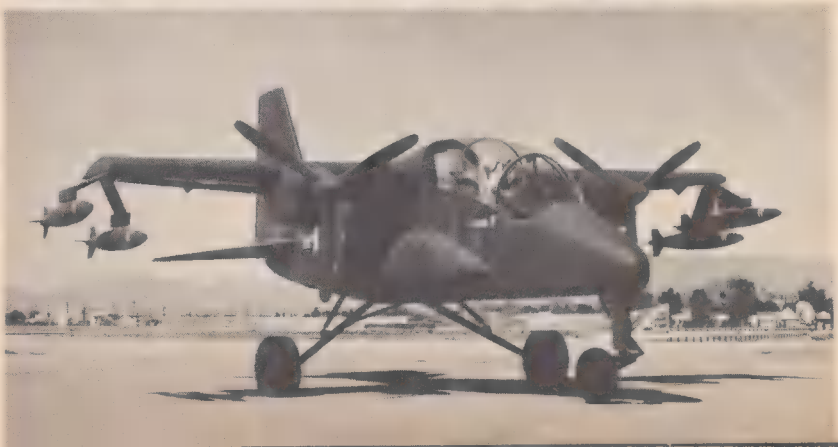
New entry in the Defense Department's competition for the design of a counterinsurgency aircraft is Lockheed-California's stub-winged, rugged little combat airplane. It is intended for armed reconnaissance, battle area close air support and for the transport of fighting men and supplies.

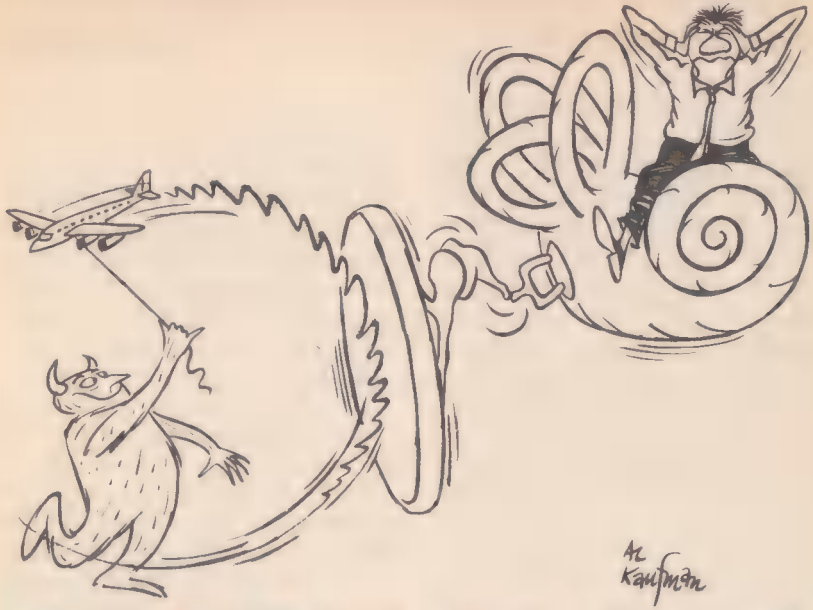
The plane features a short takeoff and landing performance. Lockheed engineers say that it could take off from the 50-yard line of the Rose Bowl gridiron and fly over the rim of the bowl.

Labeled the CL 760, the Lockheed design has a high wing, a single fuselage, and is powered by two 660-horsepower turboprop engines. It will carry up to eight combat troops or more than 4,500 pounds of cargo, plus up to 1,200 pounds of bombs, rockets or other stores on each wing tip and up to 2,400 pounds on a rack under its belly.

In addition to reconnaissance, close air support, dropping paratroops and carrying airborne infantrymen and cargo, the aircraft will serve as a combat area flying ambulance, carrying six litters. Its roomy fuselage can be jammed with cargo, air-droppable or conventional, and installation of a four-camera kit makes it a photo/reconnaissance plane.

Rugged and squat little combat plane is Lockheed's answer to the demands of jungle warfare. Suitable for reconnaissance, it can also carry troops and supplies.





Is noise driving you crazy?

It actually can—and there's more of it every day. Here's what we can do about it.

by James H. Winchester

NOISE jangles nerves, lessens efficiency, and robs us of sleep. A truck backfires, and we jump. A loud noise, and infants react with clutching, wide-eyed fear.

Many physicians speculate that there is a direct relationship between this unconscious tension and the rising tide of such stress ailments as heart disease, hypertension and other degenerative disorders.

Dr. Claude Fortier, at the University of Montreal, subjected rats to noise stress—a screaming siren. The resulting internal wreckage included thymus gland atrophy, overstimulation of the adrenal glands, and gastric ulcers. Other experiments show that a sudden door slam can raise a man's blood pressure four times, higher than the reaction from a shot of morphine. The quantity of blood pumped by the heart may double under the stimulus of even the sound of a baby crying. The increased oxygen consumption that comes with rising blood pressure results in exhaustion and nervousness.

A recent U.S. Air Force study indicates that continued exposure to a constant, disturbing level of noise can, among other things, cause indigestion, an increase in body temperature, impaired vision, and, eventually, even insanity. Some

noises can inflict actual pain.

The din in America's ear has reached the point where hushing sounds is becoming a big U.S. business. There are an estimated 1,500 physicists, acoustical engineers, mathematicians and neurologists now engaged full-time with noise control. The Acoustical Society of America has over 40 major manufacturing companies among its membership.

In industry, the noise problem has been cut down, though not eliminated. Factories have been soundproofed. Workers wear protective devices, such as ear plugs. Many large companies are landscaping their grounds with sound-absorbing trees and bushes to cut down outside traffic and other sounds. All of this pays off. A Chicago firm inspected an assembly line located near a busy boiler room and found 80 imperfections in every 100 pieces turned out. They moved the line to a quieter spot. Production jumped nearly 30 percent and imperfections dropped 90 percent. In another firm, a simple soundproofing of its offices cut absences 37 percent and employee resignations by 47 percent.

There oughta be a law

Every major city has some organization against noise. Increasing numbers of laws and ordinances against this 20th Century plague are on the books or being enacted. New York City, for instance, provides fines and even jail terms for those who play radios, phonographs or TV sets too loudly between the hours of 11 p.m. and 7 a.m. [*Edi-*

What is a noise?

Noise, as perceived by the human ear, is a function of pitch and loudness. Pitch is measured in terms of frequency—from high whistles to low rumbles and roars. Frequency measurements are expressed in cycles per second. The human ear responds to frequencies from 20 to 20,000 cycles per second. The sensation of loudness is determined primarily by the physical intensity of sound expressed in decibels. Each decibel step upwards from zero represents a 26 percent change in sound intensity.

Typically, the rustle of leaves registers a quiet, even soothing, 10 decibels. A home ventilation fan reaches 55 decibels; average conversation, at a distance of three feet, is 62; a vacuum cleaner, 90; the whistle of the Queen Mary, at 75 feet, a shrieking 120; and a large pneumatic riveter, at four feet, an ear-splitting 130 decibels. Experts agree that prolonged exposure to noise of 95 to 100 decibels is hazardous. Temporary deafness can be caused from even a few minutes'

tor's note: Ha, Ha!] Memphis, Tenn., won't permit a horn to honk except in an emergency. Moscow, like Memphis, bans horn-blowing. The traffic director there claims accidents have been reduced 10 percent by this law. Britain's anti-noise legislation allows cities to ban motorcycles entirely during sleeping hours. Philadelphia regulations block noise in construction work, garbage and trash handling, street-vendor sound devices, vehicles, and in hospital and church quiet zones.

More and more, though, people are demanding quiet in their homes, where noise problems, as a by-product of modern living, are multiplying. Larger families are living in smaller dwellings. Bigger and noisier appliances are being crammed into homes. But the chief reason for increased noise in the home, whether it's an individual dwelling or a modern, expensive apartment house, is that most construction today is "quick built." Homes have lower ceilings, long-room layouts, adjacent or inside wall plumbing and interconnecting vents. Apartment house bathrooms are often built back-to-back for reasons of economy, making them virtual monitoring booths.

A Dallas contractor recently advertised "quiet" homes, at only $600 more for each three-bedroom house. They sold quickly. Housewives now ask to "hear" appliances before they buy them. They also knock on walls to test sound when they look at a new home or apartment. Some go as far as to bring decibel meters with them.

Here are a few things to consider when apartment hunting, according

exposure to levels between 100 and 120 decibels, such as the noise created by the take-off power of a four-engine propellor-driven airliner. Noises generated by punch presses, drop hammers, drills and other machinery produce sounds with a decibel count equal to single-engine jet roars. Sustained exposure can cause deafness.

Loudness also depends to some extent on frequency, in that high frequencies sound louder than low frequencies for the same physical intensity or decibel level. If two notes of equal intensity are struck on a piano, one a bass note and the other just one octave higher, both notes will register around 80 decibels. However, to human ears, the higher note sounds much louder than the lower.

A unit of measurement called the "sone" is used to rate a sound according to both its pitch and volume. One "sone" is about the loudness of a refrigerator motor; human voices register 10 to 15 "sones"; and 100 "sones" would be pretty uncomfortable. Actually, men differ from women in their tolerance to "sound pollution." Males endure lower frequency sounds better, while women get along better with higher frequency sounds.

Can the public tolerate the sonic booms of tomorrow's jet airliners? They're finding out now in tests over Oklahoma City.

to the Owens-Corning Fiberglass Corporation, which maintains a multi-million dollar sound laboratory in Granville, Ohio, where the decibels of every home appliance, and every new home construction material entering the commercial market, are tested:

Flush the toilet. Is it unduly noisy? In any event, stall around and wait for a neighbor to flush his toilet to learn if the sound carries.

Remember that an empty apartment sounds noisier. You often hear decorators recommend special drapes to make a room quieter. Actually, the noise they absorb is insignificant. Most ordinary noise is absorbed by furniture, rugs and people in a room.

Testing an apartment

Get someone into a closed bedroom to talk in a modulated or normal conversation. Then have them shout. Does it carry into the living room? If you're alone on this test, take along a transistor radio.

When you're looking for an apartment in a new building or one that is not yet completed, ask what the materials are. Steel frame buildings which do not have poured slab concrete floors make the most noise. They are simply layers of wood and plaster with air between. It's this air space that becomes the reverberation chamber for unwanted noise. To correct it, sound-absorbing material must be filled in. Flimsy dry-board construction of walls over studs, with nothing in between except air, will also make a drumhead for reverberations.

"Within five to 10 years," says Hale Sabine, a physicist, who is in charge of Owens-Corning's Sound Laboratory, "all or most home appliances on the market will have partial or complete soundproofing." In this connection, as the results of tests by Sabine, the noise of a popular-model portable dishwasher was recently reduced from 70 to 55 decibels. This was accomplished largely through the application of sound absorption fiberglass to various parts of the machine. The cost of the material was about one or two dollars.

Jet aircraft are one of the biggest irritants in today's noisy world. Supersonic aircraft create an effect known as the "sonic boom." When the speed of sound is exceeded, the shock wave created can break windows 30,000 feet below, crack plaster and shake buildings, all with a sound like a railroad car of dynamite exploding.

To try to find an answer to this serious problem, Oklahoma City, with its 500,000 people, will be

subjected all this year to sonic booms in the first major test of public reaction to the noises that tomorrow's supersonic airliners will make. U.S. Air Force F-104 jet interceptors will simulate the airliners, which are expected to be carrying passengers at speeds of better than 1,800 miles-an-hour in the early seventies.

The study is being conducted by the Federal Aviation Agency, the U.S. Air Force, and the National Aeronautics and Space Administration, with the cooperation of Oklahoma City officials. Public acceptance of the sonic booms that supersonic airliners will create is a critical factor in the plane's development. Some say the first supersonic airliners will have to fly only over oceans, which would severely limit their usefulness.

The Federal Aviation Agency, airports, airlines and jet plane manufacturers are now deeply embroiled in the problem of the noise made as huge jetliners take off or land at airports today. Already, the aircraft industry has spent an estimated $50 million in efforts to produce a quieter jet engine, with no notably effective results. An FAA spokesman admits: "This is something which is going to get worse, not better. The public will have to learn to live with it—or move away from the vicinity of airports."

The mounting crescendo of jets, however, is only one of the quiet-shattering things that is making the world today a clattering, whining, clanging, *noisy* place in which to work and live. And if we can't learn to live with *them,* the only answer is to cut down noise. Or move away from the vicinity of the world.

Can feelings affect an unborn baby?

CAN the attitude of an expectant mother toward her pregnancy affect the course of the pregnancy? Researchers at Mount Sinai Hospital, in New York City, are trying to find out. A self-rating attitude test is being given to expectant mothers during the early months of pregnancy. Abram Blau, M.D.; Joan Welkowitz, Ph.D., and Jacob Cohen, Ph.D., reported in the *Archives of General Psychiatry* that the scores will be analyzed in the light of how the pregnancy proceeds. It is generally believed that psychological factors influence motherhood in terms of sterility, spontaneous abortion, premature terminations, and complications of delivery. The researchers point out that if this is true, complications can be headed off by preventive measures.

The test consists of 48 statements with which an expectant mother can agree, strongly agree, disagree, or strongly disagree. They concern attitudes toward the ability to carry the child to term; feelings about the health of the baby; negative feelings, depression, fatigue, and nausea; and attitudes toward breast feeding.

Navy's super new plane taxis into position on the carrier Saratoga before taking off in

New Mach 2

A-3B Skywarriors, which the A-5's will replace, formerly were primary striking force.

mock attack on Dallas. The A-5 Vigilante has range of 2,300 miles, more with refueling.

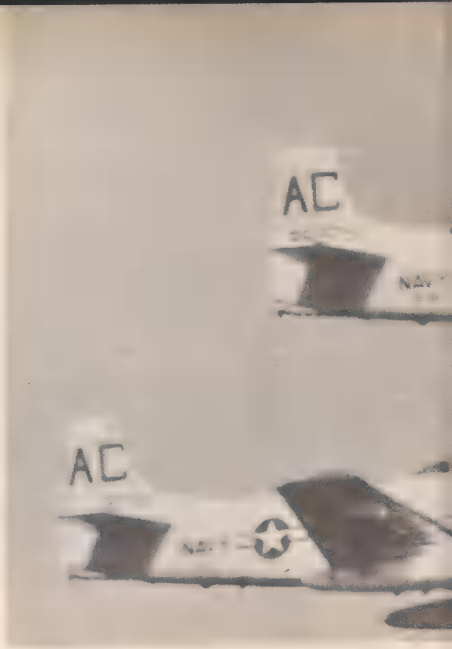
Carrier Plane...

On the afternoon of last May 21, attack planes took off from the aircraft carrier *Saratoga* in the Atlantic as another flight of planes took off from the carrier *Coral Sea* in the Pacific. Within a couple of hours, planes from both oceans had met over Dallas to conduct a mock nuclear attack on the Texas city.

Among the aircraft launched by the *Saratoga* were units of the first operational squadron of the Navy's impressive new fighting machines like the one pictured above. It is the A-5 Vigilante (North American), a twin-jet, two-seat, all-weather combat aircraft with the ability to carry nuclear weapons several hundred miles. Capable of a speed over Mach 2 (twice the speed of sound), the A-5 is equipped with four wing attachments, each capable of carrying a bomb or a missile.

The aircraft will supplement the A-3B Skywarrior (left) and eventually replace it. It can operate at both extremely high or extremely low altitudes, so that it is adaptable either to so-called "brush-fire" wars or to general war.

Saratoga flight deck crew members watch new planes in action before air exercise.



Last propeller-driven attack planes based on Navy carriers, A-1H Skyraide

...Goodbye

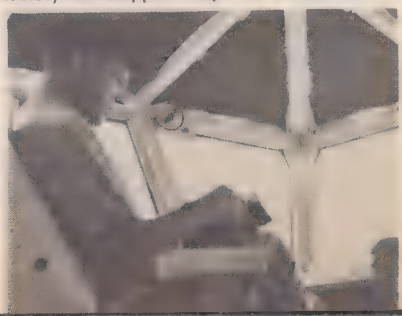
For the same mock air attack that the A-5 Vigilantes took part in (p. 32), the *Saratoga* took on and launched units of another impressive new class of Navy plane. This class has to be impressive because it replaces the last of the Navy's attack prop planes.

The A-6 Intruder, pictured below on opposite page, represents the first jet designers have been able to come up with to surpass the all-around performance of A-1H Skyraider.

Unmatched in its class since the Korean War, the Skyraider will give way to a Mach 0.9 (at sea level) low-level attack bomber with the same staying characteristics that have been the A-1H's principal advantage. The new jet A-6 has a 3,000-mile ferrying range. It can carry two Bullpup air-to-air missiles plus three 2,000-lb. general purpose bombs, or 30 500-lb. bombs. It can also carry nuclear weapons.

And the A-6's DIANE (digital integrated attack navigation system) enables the plane to zero in on targets even when obscured.

After launch of Saratoga's planes in exercise, her skipper: Capt. J. E. Lacouture.



combined long range with ability to carry own weight in conventional or nuclear arms.

to Prop Planes

A-6 (Gruman), first jet able to replace prop A-1H, sports high refueling intake pipe.

YOUR SCIENCE ABC's

masers and lasers

ELECTRONIC MIRACLES OF THE FUTURE

If you follow science news, you may have met the words "maser" and "laser." Both of these are remarkable new devices that work on a new electronic principle. Masers are very powerful radio amplifiers that are helping radio astronomers listen in on the stars. Masers may also help relay television programs across the Atlantic via satellite, and they can be used to build clocks of unheard-of accuracy.

Lasers can generate beams of light intense enough to cut metal, and will allow the use of light waves, as we now use radio waves, for sending messages out into space.

The maser was invented by Dr. Charles H. Townes of Columbia University in 1955. To see what a maser is and how it works, let us talk about one kind of maser—the hydrogen maser. It was not the first maser built, but it is one of the easiest to explain. Atoms resemble tiny solar systems, with lightweight electrons in orbit around the atom's heavy nucleus. The atomic solar system, however, has a very important peculiarity. Unlike planets in

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The heart of this laser, or optical maser, is a ruby immersed in liquid nitrogen.

a real solar system, electrons in the atomic system can change their orbits or the way they line up within their orbits. Some orbit-to-orbit "jumps" can occur only if the atom is struck by a light ray or receives energy in some other way. In other orbit jumps, the atom gives off a light ray, a radio wave or an X-ray.

Now consider the hydrogen atom. It has a single proton in its nucleus and a single orbiting electron. When that electron makes one particular kind of jump, the hydrogen atom gives off a radio wave with a wave length of 21 centimeters (about 8 inches). Moreover, if things are arranged in the right way, hydrogen atoms will give off a lot (comparatively speaking) of 21-centimeter waves when exposed to a small amount of 21-centimeter radio energy. But this is amplification—making something big out of something small. So a hydrogen maser can be used as an amplifier for 21-centimeter radio waves.

It happens that 21-centimeter radio waves are of great interest to radio astronomers. Many of the "signals" from the stars that they listen to have that wave length. But there are maser amplifiers that can be tuned to other wave lengths too (all, though, in the very short radio wave lengths called microwaves). So many radio telescopes now have masers to pick up and amplify very weak radio waves from distant stars.

Masers can also be built to serve as clocks. Here is the idea behind the maser clock: Just as a radio station broadcasts on a fixed frequency—so many kilocycles, depending on what frequency has been assigned to it by the government—so, hydrogen atoms, for instance, put out radio waves on a fixed frequency. In the case of the 21-centimeter wave, the frequency is 1400 million cycles per second. Now, the hydrogen atom holds this frequency much more accurately than any radio station. There are 1400 million oscillations in every second and an exactly proportional number in any fraction of a second.

These tubes containing helium and neon are vital elements in research with lasers.

The oscillations can be used to measure time far more accurately than has ever been done with any clock. Scientists believe that one maser clock, now under development, will ultimately measure time accurate to one second per hundred million years.

Atomic electrons can be made to give off light as well as radio waves by orbit-to-orbit jumps. (This is different from other ways in which atoms can be made to give off light.) Soon after the maser was invented, several scientists figured out how to use the maser scheme to produce light. Thus the "light maser" or "laser" was born. There are already many different kinds of lasers. Some use a gas, like neon, others are made of a gem, like ruby. All work in basically the same way.

Light or infra-red (heat) rays are used to "pump up" atomic electrons to an outer orbit. When the electrons are triggered to return to inner orbits, they give off light.

Light from a laser has remarkable properties. First of all, it is spectrally "pure," just one wave length, not a mixture of colors and wave lengths like white light or even ordinary colored light. (Which color a laser emits depends on the type of laser.)

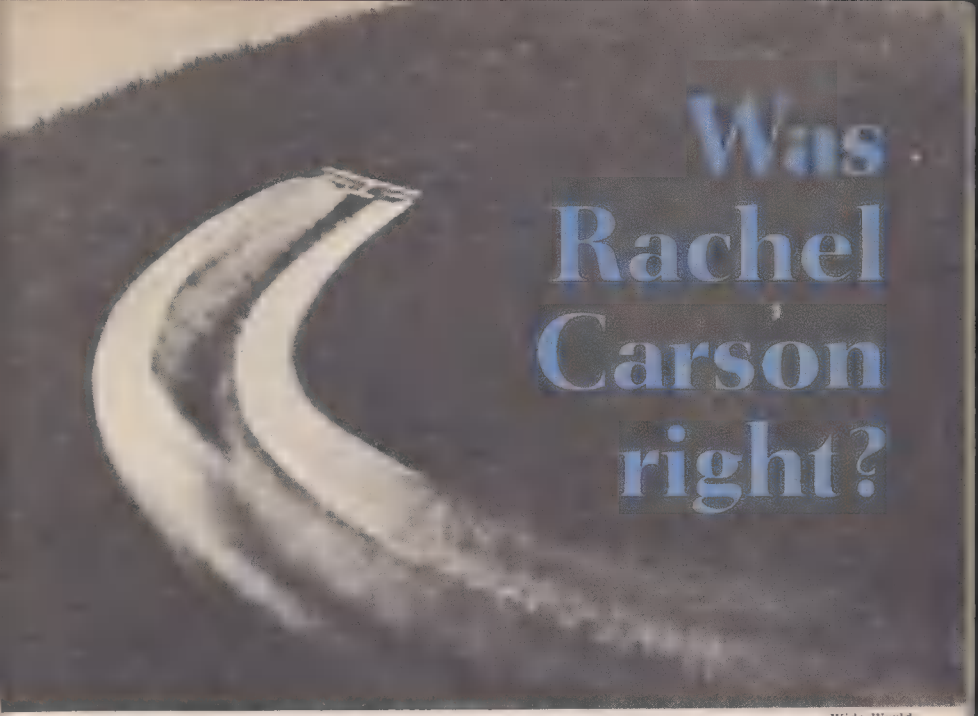
Second, a laser beam can be focused much more sharply than an ordinary light—so that it has a spread of only one foot at a distance of 100 miles. As a result it can be made very intense—so intense it will cut metal by melting. Finally, all the waves are in step like the radio waves generated by a broadcasting station. This means that light from a laser can be used for broadcasting. Space scientists are already talking about using lasers for broadcasting to space vehicles because light travels very well in space. Telephone engineers foresee the day when laser light beams will carry telephone messages and we will talk over a beam of light!

The devil and the deep blue sea

WHAT does the word "conformity" mean to you? According to psychologist Stephen B. Withey, writing in the *Michigan Quarterly Review*, "For many, conformity has an ugly ring. It seems to suggest the loss of novelty, surprise, individuality, creativity . . . substituting norms for standards.

"On the other hand, for many, 'nonconformist' has an equally unattractive sound. It sounds dangerous, deviant, 'way-out' and rebellious. . . ."

Even the far out are usually conforming to far out standards, it seems. "Studies have shown that people who have rather extreme or 'far-out' ideas tend to feel that at least their friends agree with them; although they are deviants in one group's definition, they are conformist in another. Only the most rugged of us can stand for long without social sharing. . . . Only the sick can do it extensively."



Was Rachel Carson right?

Wide World

Billowing waves of DDT fan out over the timberland. But how far did deadly effects of this pesticide extend beyond the spruce budworm, the intended victim?

Two years after the late author of "Silent Spring" warned of its consequences, the big kill of pesticides is bigger than ever. Here is where the pesticide problem now stands.

by Bruce H. Frisch

As the autumn chill reaches Louisiana this year, fishermen along the Atchafalaya will scan the river and sniff the air for signs of dead fish. Last year, 5,000,000 swollen carcasses lined the banks of the Atchafalaya and the lower Mississippi which feeds it. Most of the fishermen had to abandon their houseboats and nets and head for town to look for other work. The Public Health Service (PHS) blamed endrin, a pesticide.

There is little reason to think it won't happen again. Over two years after Rachel Carson pointed out such undesirable side effects of pesticides in *Silent Spring,* no really decisive action has been taken to prevent them.

In the spring of 1962, Miss Carson, a biologist turned author, packed four and a half years of research into a series of articles for *The New Yorker* magazine. Her main thesis was that the indiscriminate, wholesale use of pesticides was killing desirable insects, fish, birds and

The world faces starvation if it listens to Miss Carson, said chemical spokesmen. "I do not favor turning nature over to insects," she replied.

wild animals and was a possible long-range threat to man.

In September of that year, the book version of *Silent Spring* became a best-seller. The chemical industry counterattacked by saying the world faced starvation if it listened to Miss Carson.

She replied, "We must have insect control. I do not favor turning nature over to insects. I favor the sparing, selective and intelligent use of chemicals. It is the indiscriminate, blanket spraying that I oppose."

In 1962, the United States used 175,000 tons of pesticides, one drop of some of them enough to kill a man.

More and better pesticides

Miss Carson's efforts seemed in vain. Sales of pesticides rose 16 percent for the year to $345,000,000 and the National Agricultural Chemicals Association doubled its public relations budget.

But her book did give new urgency to a pesticide study by a special panel of the President's Science Advisory Committee (PSAC). When the committee's report came out in May 1963, it vindicated Miss Carson.

The discovery of the insecticidal properties of DDT in 1939, the report pointed out, began a tremendous expansion of chemical pest control with synthetic hydrocarbons.

DDT is a chlorinated hydrocarbon. These act on the central nervous system. Although DDT can cause illness, it is not a deadly poison to humans. A fatal dose of chlordane, on the other hand, is one-fifth to two ounces. Other chlorinated hydrocarbons are lindane, aldrin, dieldrin, endrin and toxaphene.

The organic phosphorous compounds, the second main group, are much more toxic. After their killing power was discovered by a German chemist, in the late '30s, some of them became deadly nerve gases.

Nerve impulses are electrical impulses transmitted along nerves by a chemical reaction in which acetylcholine is formed. Ordinarily the reaction is immediately reversed by the enzyme cholinesterase. Organic phosphorous insecticides inhibit the action of cholinesterase so that acetylcholine accumulates. In humans, this leads to sweating, salivating, filling of the lungs with liquid, muscle twitches, convulsions, coma and death. The lethal dose for parathion is one-three thousandth that for chlordane.

Today there are over 60,000 pesticides registered in the United States for killing insects, fungi, unwanted vegetation, rodents, nematodes—a kind of worm that sucks

Rachel Carson

juices from roots—and snails and slugs.

The committee found that there were immediate and long-range hazards to man and other animals and that the government had not been protecting against them or learning exactly what they were.

The very next day after PSAC presented its report, Senator Abraham Ribicoff (D., Conn.) started hearings on pesticides before his Senate Subcommittee on Reorganization and International Organizations of the Committee on Government Operations. He soon found a weakness in the government control apparatus.

Manufacturers must register a new pesticide with the U. S. Department of Agriculture (USDA). Evidence must accompany an application to prove the pesticide is safe and effective if used according to directions developed for its use.

If the pesticide is for a food crop and will leave a residue, the Food and Drug Administration (FDA) sets a tolerance. In a showdown, however, USDA had no real power to prevent sale. If USDA thought a pesticide was unsafe and refused to register it, the manufacturer could insist on registering it under protest and sell it under a label which in no way showed a customer that it wasn't accepted by the government. Twenty-five products over 15 years had been registered under protest. Senator Ribicoff proposed a bill to close this loophole.

Shortly after the Senate hearings began, Representative John Dingell (D., Mich.) began calling witnesses before his subcommittee of the House Merchant Marine and Fisheries Committee to testify about the effects of pesticides on wildlife.

Secretary of the Interior Stewart L. Udall seized the opportunity to tell the committees about long-lasting, widespread harm. Although only about one acre out of every twelve in the United States is treated each year with pesticides, the chemicals have spread around the world.

The diffusion starts when they are applied. Tracers to study air pollution from spraying have been detected up to 22 miles away. Grapes have suffered from plant-growth controllers sprayed eight to 12 miles away.

Later the chemicals work up through the food chain to migrating

Dead fish in the Mississippi basin were not the only pesticide victims there. Turtles, birds, otter and mink had perished along with them in the annual slaughter.

animals. DDT has been found in duck eggs in the Yukon, a gray whale off California, fish off Asia and Northern Europe.

Another road pesticides travel is through ground water to rivers and down to the sea.

Chlorinated hydrocarbons remain dangerous longest.

An accumulation of poison in the body can cause lower reproduction rates in birds and mammals—the American bald eagle may be a victim.

Two edged weapon

Pesticides do not always get rid of pests. Clear Lake, Calif., had gnats. They didn't bite, but there were so many, up to 1,000 per square foot, that they were bothersome. DDT was sprayed on the lake in 1949, then again in 1954 and 1957 when the gnats rebounded. After the 1954 spraying some of the swan-like Western grebes died. Even more died after the third spraying, until in 1960 they had dwindled from 1,000 pairs to 30 pairs.

The water no longer contains DDT; it is all in the plants and animals around the lake. In the summer of 1963, the amount of residue was as high as ever.

The gnats continued to revive. Scientists switched to the less persistent organic phosphate, methyl parathion, in 1962, and had to repeat the dose in 1963. Finally, last year the California Department of Fish and Game sent to Oklahoma for fish they hoped would be gnat-eaters, and the scientists began studying diseases of the gnat.

Natural controls like these were advocated by Miss Carson. Their use has been quite limited until now. Only about 100 insect predators have been successfully introduced into this country. Other alternates to insecticides are parasites, resistant crop varieties, sterilization of male insects by radiation, chemical sterilants, sex lures and physical attractants such as light to draw insects into traps.

Their chief advantage is that these methods avoid blanket killing. In some cases they have proved quite cheap. Their main drawback is that they often take a long time to develop, and there have been few of them. Even before the new chemical discoveries "for every success with nonchemical insect-control procedures there were ten successes with chemicals," claims E. F. Knipling of the USDA Entomology Research Division.

Yet natural controls are working for us all the time. Only after natural forces have done their work are the insect armies brought within reach of chemicals.

When broad-spectrum chemicals kill off an insect's enemies the situation can be made worse instead of better, or an insect normally held in check may multiply into a menace. Sometimes a second spraying must follow to kill an insect that was harmless before the first spraying.

In 1963 the chemical industry spent close to $40 million on pesticide research, but natural controls rarely have commercial value. Even within the Entomology Research Branch of USDA the budget in the pre-*Silent Spring* year of 1956 was split 69 percent for work on chemical control and about 21 percent for other controls.

Facts like these prompted Representative Dingell to propose two bills. One would require a pesticide label to state if it were dangerous to wildlife. The second would require the USDA to consult with the Department of the Interior on the safety of a new pesticide for fish and wildlife before registering it, much as it consults with FDA about the safety for people. Secretary of Agriculture Freeman wants to hold both bills "in abeyance."

Congressional hearings continued into the summer of 1963 with no results. A long quiet followed.

Meanwhile a committee of British scientists had been studying agricultural and food storage poisons. On receiving their report the Minister of Agriculture placed severe restrictions on the use of dieldrin, aldrin and heptachlor. "The committee regard it as a matter of concern that traces of the chemicals are being found in so many situations and express the firm opinion that accumulative contamination of the environment by the more persistent organo-clorine pesticides should be curtailed," he told Parliament.

That same week the United States was brought face to face with the problem when the Public Health Service (PHS) announced that it had found dieldrin, endrin, DDT and DDE in some of the 5,000,000 fish killed in the lower Mississippi basin since the start of cold weather the previous fall. A total of 10,000,000 had died in the past four years. Turtles, birds and even otter and mink had perished with the fish.

Two weeks later PHS pinned the blame on endrin as the "most likely cause" of the fish deaths .

Dumping deadly chemicals

Shortly after, the Department of Agriculture began travelling hearings in Washington, Memphis and Baton Rouge on whether to restrict or ban endrin, dieldrin and aldrin, which is often converted in nature and shows up as dieldrin. Less than a month after the hearings began PHS grew more positive and stated flatly that endrin "was responsible" for the 1963-64 fish kill.

At first the health service suggested that normal applications of endrin washed into rivers accounted

Fish kills are one thing, but what are insecticides doing to humans? Strong proof would be required before the FDA could virtually ruin an entire food industry.

for all the poison. The cotton-growing states used about 1,689,000 pounds of endrin last year. Further detective work led the service to charge that by careless handling of wastes the Velsicol Chemical Corporation pesticide plant in Memphis, Tennessee, was a major contributor.

This prompted Senator Ribicoff to reopen hearings in his subcommitte from which arose a proposed bill. One part was to insure the labelling of packages of pesticide with the correct contents. The second part was to prevent pesticide manufacturers and packagers from dumping wastes into rivers.

What really shook PHS was not the fish-kills themselves, but their implications for humans. The pesticides found in the fish came from the river water. Cities along the river purify the water for drinking, but don't remove the pesticides. In addition, endrin, dieldrin, DDT, DDE and heptachlor have since been found in Louisiana river shrimp, and endrin in Louisiana and Mississippi oysters.

The FDA, from animal tests and other criteria, sets a limit on the residue of each pesticide in food. For most the tolerance is small, but finite. For heptachlor and endrin the tolerance is zero. In practice, "zero" means "undetectable." New methods of analysis that enabled PHS to trace the fishkill to endrin in the first place, now uncover previously undetectable amounts. By law, FDA should seize oysters containing any endrin. Instead, FDA shrank from virtually ruining a whole industry. It will survey the whole season's harvest, then contemplate a move.

A similar situation arose in milk. Since milk is the main food for infants, FDA set a zero tolerance for all pesticides. Spot checks in the spring turned up heptachlor in milk from 14 farms near Baltimore. The milk was dumped.

Too much to be done

The suspicion arose that more tests would reveal a widespread problem. District of Columbia health officials stopped checking, because it was "too time consuming."

On top of a daily dose of pesticide from food and drink a person may absorb more insecticide through the skin from mothproofed clothing. Even ordinary dry-cleaning fluids sometimes contain insecticide as a routine thing.

PSAC was concerned about what could happen when two different

pesticides arrive by these different routes to meet in the same body. "Some combinations of two organic phosphates have produced effects 10 times those observed when either compound was fed separately."

To further complicate matters, our knowledge of what harm, if any, comes from long-time intake of small amounts of pesticides is scanty. The chlorinated hydrocarbons are of the most concern, because they persist the longest. Yet, in *Clinical Memoranda on Economic Poisons*, put out by the PHS Communicable Disease Center, appear statements like these: "Nothing is known of chronic systemic benzene hexachloride poisoning from the study of human subjects." "The minimum dosage daily of DDT producing illness in men is not known." "Little is known quantitatively about the chronic toxicity of dieldrin for man."

The question is, does "unknown" mean "not proved harmful," which is the assumption on which we have, in effect, been acting, or does it mean "potentially dangerous," as Rachel Carson claimed.

Out of the many hearings came one, lone bill. On May 12, President Johnson signed a bill ending the sale of pesticides that had been denied registration by USDA. It had negligible immediate impact.

In the summer of 1963 the *Congressional Quarterly* had found "little action has been forthcoming." Almost a year later, the *New York Times* found "bureaucratic apathy," and *Science*, publication of the American Association for the Advancement of Science, reported "piecemeal and inadequate" federal reaction to pesticides.

Meanwhile, the 1964 spraying season opened with the biggest fish-kill ever experienced on the Missouri River shortly after toxaphene and dieldrin were spread on wheat fields to kill army worms. A big part of pesticide research will continue to be counting bodies.

★ ★ ★ ★

An old trick to quickly reduce body temperature

REMEMBER how to cool off during particularly hot weather, you used to hold your hands and wrists under cold water or place ice cubes on your wrists? Remember how the water seemed to cool the blood as it passed through your hands, and how the blood, in turn, cooled your body?

Dr. Judah Minkin, of Putnam Valley, N.Y., suggests that his fellow physicians use the same technique to reduce the body temperature in patients with high fever. It works just as well, he says.

Here is his technique: Have the patient place each hand, including the wrist, into a basin of cold water. Within 15 minutes his temperature will begin to go down. This technique is just as effective as the usual one of sponging the body with tepid water or water-alcohol mixture; it certainly is simpler—and less time-consuming since it does not demand a nurse's constant attention. And it is easier than immersing the patient in a tub of cold water; certainly it is more comfortable for the patient.

Should we freeze the dead?

ONE of the characters in the "Lil Abner" comic strip, filthy-rich General Bullmoose, kept himself from aging too quickly by sleeping in a deep-freeze.

Just funny paper stuff, you say. Not to Robert C. W. Ettinger, a college physics professor and author of the book *The Prospect of Immortality* (Doubleday, New York, $3.95). Ettinger proposes that we freeze the bodies of people who have died of diseases which are today incurable. These persons would be "revived" at a time when medical science could cure the disease. Beyond this, he proposes that we freeze the bodies of people who have died of old age, in the hope that old age will be reversible in some future era. In fact, he proposes that we freeze anybody who has died of anything, short of being totally consumed in a fire or smashed to a pulp in a plane crash.

Nor does he suggest waiting until the day that freezing techniques are perfected. At the present state of knowledge, a frozen human body would be little more than cold meat, which would slowly deteriorate, no matter how carefully attended. Biologists have had some success in freezing and reviving lower animals, but no success at all in reviving higher animals which have been frozen. Still, someday, in that wonderful future, Ettinger believes, scientists will have the knowledge to correct even the damage that will result from today's inadequate freezing techniques.

"There already exist," he writes, "at least three organizations dedicated to the furtherance of the freezer program, at least two of them legally incorporated. Many others can be expected to spring up shortly. . . ."

"The first human may be frozen before the end of 1964. . . . (Possibly a few wealthy people have been quietly frozen already!) Thereafter, events will gather speed. . . ."

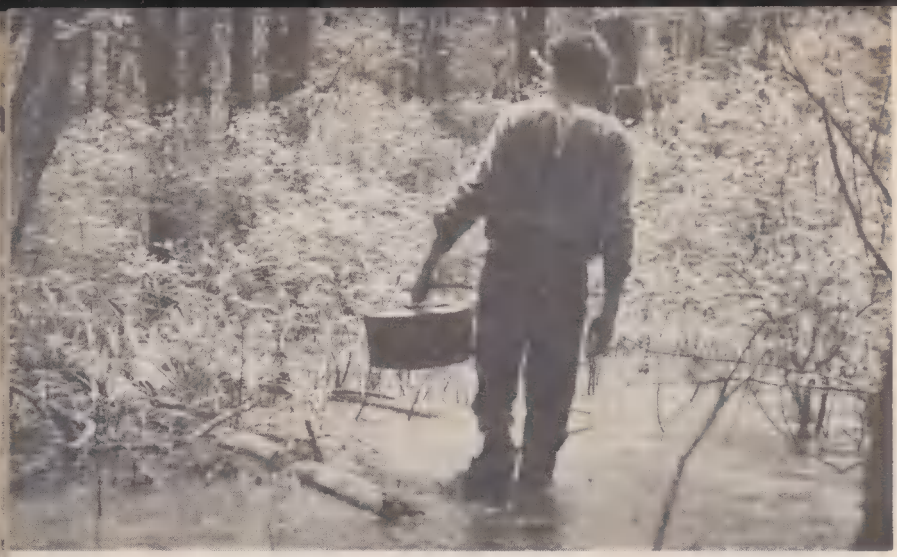
Ettinger attacks all the social, moral and religious problems that would doubtless result from a large-scale freezing program with the same determined optimism he displays toward the medical and scientific problems involved. They can all be solved—someday, in that wonderful future. Since man historically has been less successful in coping with himself than he has been in coping with nature, one wonders how much Ettinger's optimism is justified.

Most of Ettinger's proposals are built on sand, maybe even clouds, and they are easy to ridicule. But one hesitates, because the idea of personal physical immortality is so compelling that you want to believe him, even if you can't.—*D.C.*

Photos and text by George Laycock

SNAKE HUNT

Hunting snakes, poisonous and otherwise, is one of the favorite sports of herpetologist Rickard F. Dooley. It is also a business with Dooley. After graduating from Cornell University, Dick Dooley worked in some of America's leading zoos, including the Bronx Zoo in New York City and the Cleveland Zoological Park, and he eventually went into business for himself as director of the Kentucky Reptile Gardens at Park City, Kentucky, not far from Mammoth Cave. The giant cottonmouth he holds here was taken on a snake hunt in a western Kentucky swamp where Dooley often goes for new reptiles (see story, next page).



Hunting for cottonmouth moccasins in a swamp overgrown with mid-summer vegetation is an exciting and exacting business. Dooley waits for a bright day when the snakes will be sunning themselves on logs. Then it's a matter of slipping up on them, a step at a time, keeping a watchful eye open for lurking reptiles, and, when you spot one, pouncing on it before it has an opportunity to slip into the murky waters.

Dooley deals in reptiles and supplies zoological gardens over a wide area. Some of his reptiles find homes in his own reptile gardens where Dooley lectures and displays them.

His snake hunting has taken him as far as India and Pakistan to collect animals, reptiles and birds for American institutions. He is also a lecturer and has displayed his snakes to hundreds of audiences. To demonstrate that the bite of an nonpoisonous snake is not to be greatly feared, Dooley aggravates a blue racer until it strikes his hand. His fearlessness with reptiles has led to some serious bites, including one from a 5½-foot diamondback rattler. Dooley lay in a coma for eight days, and was paralyzed for two weeks before beginning to recover.

He is a slightly-built scientist, with bushy black hair and clear blue eyes. His reactions are lightning fast. When he reaches for a snake he seldom misses. His snake collecting career began at the age of seven. When he was 10, Dooley saved $10 and, instead of buying a ball glove as most boys might, he bought a boa constrictor.

Using his snake hook, Dooley deftly pins the dangerous head of the twisting cottonmouth to the swamp floor long enough to drop the tail and quickly grab the reptile behind the head close enough so that it cannot turn on him.

Dooley quickly grasps the moccasin to immobilize it after snatching it from the log where it suns. Helpers usually limit their "help" to spotting reptiles for Dooley to capture.

This hunt was at the northern extreme of the cottonmouth range in Kentucky. In the swamp where Dooley went to hunt these snakes, the local farmers long ago fenced it off from their stock to protect them from the snakes. And so abundant are the reptiles that local people venture into the swamp only in wintertime, when the cottonmouth moccasins are hibernating.

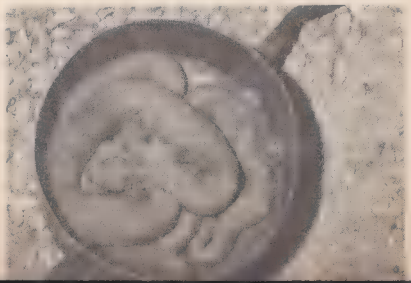
Dooley's equipment for snake collecting, aside from iron nerves and a good knowledge of his quarry, consists of his snake hook and a round fiberboard snake box in which to carry snakes. He wears sneakers for walking in the swamp waters, but recommends that anyone accompanying him wear high waders. He finds the snake box easier to handle than a sack and the box provides more protection—for the snakes.

"Some people," says Dooley, "think moccasins can't bite under water, but they can. Sometimes they stay under water a half hour without coming up for air." They live on fish, frogs, baby turtles and other snakes. They already have fangs when they are born, eight to 12 at a time.

The moccasin is a heavy-bodied snake of dark brown or black coloring that grows darker as he increases in age. He bears a close resemblance to the common water snake, which is not poisonous. You can tell them apart quickly if you see them swimming; the moccasin swims on top of the water, the non-poisonous one with only its head above water.

This close-up shows the cottony inside of the moccasin's mouth and the needle-sharp fangs against which the snake hunter must guard himself. The venom is honey-colored and it dripped in large drops from each fang as this picture was taken.

At the end of the hunt the snakes are safely stored in a round snake box. Dooley was especially pleased with the largest snake of the day, shown on page 47. It was one of the largest ever taken in this part of Kentucky.



the progress of MEDICINE

The six-day shower cure

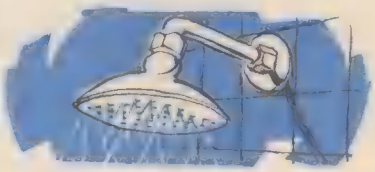
Arthur J. Snider

THE ancient Chinese tortured prisoners by letting water drip on them day and night.

In New York, a physician has adapted the idea for very different purposes. To relieve pain and hasten healing in persons burned by such chemicals as lye or bleach, they're put under a steady shower, either in a stall or bathtub, for as long as six days at a time. They even sleep in the shower, but step out to be fed.

Dr. Bertram E. Bromberg of Long Island, N.Y., says that while water irrigation has long been a standard approach to treatment of burns, it has been applied for brief periods—30 to 60 minutes. By keeping the water flowing over the patient constantly, the tiny caustic granules imbedded in the charred tissue of the body are steadily diluted and washed away. The water also slows down the tissue metabolism rate and lessens inflammation.

The method has been tried on 273 patients at Kings County Hospital in Brooklyn and the Meadowbrook Hospital in East Meadows during the last six years. The time under water ranged from six hours to six days.



Of the 85 patients followed to date, prolonged and continuous irrigation reduced the waiting period for skin grafting to 22 days compared to an average of 30 days obtained by other methods. The number requiring skin grafts was reduced to 20 percent, compared to 34 percent treated by either brief irrigations, continuous soaks with salt water, weak neutralizing solutions or treatment in which the burn is left without a dressing.

Dr. Bromberg says the number of cases is still too small to be con-

clusive, but it does suggest to emergency rooms that prolonged showering may be of value in preventing serious deformity.

"The showering is easily tolerated," says Dr. Bromberg. "The patients rarely have to be medicated and appear to gratefully accept the torrents which quickly relieve the pain. Shower temperature is adjusted for comfort and becomes so soothing the patient dozes while sitting."

In cases where the patient is too critically burned to sit up, a hose technique has been improvised for the bed.

Most of the burns are caused by what Dr. Bromberg calls "12-cent pistols"—cheap materials available in any grocery store in the form of household caustic agents. They are often inflicted by "professional lye-throwers, usually elderly women, who can be hired for anywhere from $15 to $40 a maiming."

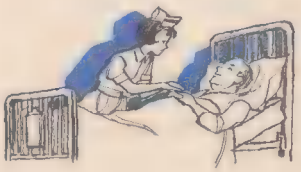
The crucial 24 hours

A large industrial concern has analyzed data on five years of heart attacks occurring among its 86,000 employees and found the outlook for those who have survived the first year is better than it has been thought to be.

But at the same time, the mortality rate immediately after the attack is worse than it had been thought to be. One out of every four of the 1,331 male employes stricken died in the first 24 hours.

The statistics indicated that if the patient survived the first 24 hours, the odds were 94-6 that he would be alive in 30 days. If he survived 30 days, the odds were about 3-1 he would live five years.

The material, collected from 79 plants of E. I. du Pont de Nemours & Co., also showed that contrary to general medical opinion, obesity was not an important factor in affecting the outcome. The five-year survival rate for the overweight individual was 74 percent compared to 79 percent in the normal weight group.



High blood pressure and increasing age were detrimental factors. Salaried white-collar workers fared only slightly better than skilled and unskilled wage earners.

A somewhat better chance to survive was found if the attack occurred in the daytime. While this may have been due in part to the greater accessibility of medical attention, the authors—Dr. Sidney Pell and Dr. C. A. D'Alonzo of Du Pont—believe there is some evidence the body may be better able to cope with an attack when the basal metabolism rate is not at a night-time low but instead is elevated through moderate activity.

The degree of physical activity at the time of attack had little, if any, effect on the immediate prognosis.

In an editorial accompanying the report, the *New England Journal of Medicine* said it seems apparent that good care in the first 24 to 48 hours after a heart attack is of crucial importance, perhaps even demanding continuous monitoring, whereas after 48 hours it appears that efforts may be relaxed, at least for patients with mild or moderate attacks.

Why some children hate meals

"Poor appetite" is one of the commonest complaints heard in the office of pediatricians. Mothers, apparently convinced a child is healthly only if he is amply proportioned, insist he "doesn't eat enough to keep a bird alive." They confess to force-feeding and even to opening the child's mouth and pushing in the food.

This kind of conditioning, in the belief of Dr. R. S. Illingworth of the University of Sheffield, England, is the chief cause of poor appetite. The child soon comes to consider mealtimes thoroughly unpleasant. He becomes conditioned against eating.

"I have seen children who begin to cry as soon as a meal is ready because they know that mealtimes are so unpleasant," Dr. Illingworth writes in *Clinical Pediatrics*.

Another factor is the mother's anxiety, caused by the constant reminder in books, magazine articles and newspaper stories of the importance of nutrition. Mothers become anxious when the child refuses food which she has been told is "good for him."

"Her baby's weight is plotted regularly on a chart, and she weighs the baby every day or so at home," the pediatrician says. "All children have ups and downs or stop gaining when they are ill. But when this happens, the mother gets worried.

"In addition, she may be unaware of the great difference between the 'average' and the 'normal.' She thinks the graph refers to the normal when in fact it refers to the 'average.' It is difficult for her to realize that a child may be pounds below the average and yet be perfectly healthy."

All children are different. There are little eaters, big eaters, small children and big children—all of the same age. Appetites vary not only from child to child, but in the same child from week to week, even from mealtime to mealtime.

Dr. Illingworth adds: some children have no sense of time. They dawdle. They do not see any reason to hurry. They play with their food and act as if they don't want it. The mothers think they have a poor appetite, become concerned and try to make them eat more—and so they refuse.

Mothers are reminded that children at five months or so begin to show their individuality, likes and

dislikes. A baby may refuse food because he was once given some that was too hot. He may refuse food not placed in his favorite dish or glass. Some children refuse food because they want to feed themselves, whereas the mother will often insist on feeding the reluctant child with a spoon.

"If a child discovers that his mother is extremely anxious about his appetite, or about his taking a particular foodstuff, he will refuse it," the physician points out. "If he can get the whole house to revolve around his appetite, he will thoroughly enjoy it. If he discovers that he will be given bribes to get him to eat, he will refuse food because it pays. If he is clever enough, he will put the price up. I saw one child who had acquired more than 200 toy motor cars in bribes."

Boston Irish vs. Dublin Irish

Patrick O'Toole immigrated to Boston from Ireland when he was 25. He is now 45. He is 5 feet 9 inches, weighs 175 pounds, has a blood pressure of 138/85, a normal heart graph and a blood cholesterol level of 233. Doctors say his health is just average.

Patrick's brother, Declan, has remained in Ireland. He's 46, eats 600 more calories a day but weighs 12 pounds less. Though he eats much more animal fat, bacon and sausage, as well as more butter, his cholesterol level is much lower (207) than Patrick's and his blood pressure is also lower.

Patrick and Declan are one of 178 pairs of brothers—one living in this country, one in Ireland—whose living and medical patterns are being minutely charted and analyzed by the Harvard University School of Public Health and the Moyne Institute of Preventive Medicine, Trinity College, Dublin.

The study, says the journal *Roche Medical Image*, is designed to determine why the Boston Irish have a significantly higher death rate from coronary heart disease than those in Ireland. The actual rates are 546 per 100,000 in men over 40 as against 363 per 100,000. By confining the study to pairs of blood brothers of nearly the same age, the Ireland-Boston Heart Study has reduced as much as possible some of the variables that may affect statistical correlation studies of the disease.

Dr. Frederick J. Stare of Harvard, study director, said the finding that the Dublin Irish eat more animal fat yet have a lower blood cholesterol level already raises the question of whether the high intake of animal fat is necessarily bad for Americans.

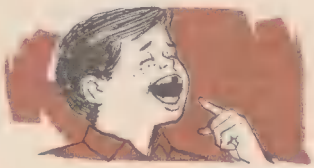
The answer may lie in exercise. Bostonion subjects engage in work of moderate physical activity, have cars or ride in car pools. Their only

vigorous exercise is gardening or shoveling snow. The Irish subjects are farmers who do much physical labor, rarely own a car or labor-saving equipment. Walking or bicycling to the village is a part of their way of life.

New life for old teeth

Dr. Ralph R. Mezrow, a Philadelphia dentist, had one young patient who was losing teeth and another who had one tooth too many. It seemed a shame to throw the extra tooth out so he implanted it in the mouth of the first youngster. That was five years ago and the transplanted tooth is still functioning. So are four more he has placed in the same patient's mouth obtained from other sources.

After anesthesia, he explains, the gum is opened, the tooth inserted into the empty socket and then shaped to fit snugly. Often where a tooth has been absent for a long time, the socket is filled with bone and a new socket must be drilled. Sometimes a plastic splint is added to brace the new tooth for several weeks.



Thus far, Dr. Mezrow has transplanted some 95 teeth in about 70 patients. Only a few have failed. Among the successes was an eight-year-old boy who knocked out a tooth diving into a swimming pool. Dr. Mezrow instructed attendants to empty the pool and vacuum it till they found the tooth. It was inserted immediately and has remained for the last eight months.

Why teeth can be transplanted successfully while the body rejects most other tissue transplants is still a mystery, Dr. Mezrow says. He believes that bone may be similar to the cornea of the eye in that there are few blood vessels to provoke a rejection reaction.

Cancer research martyr

Ten years ago, Prof. Olive S. Davis isolated a virus which causes cancer in chickens. Now she has a cancer and believes the virus has caused it. If so, Dr. Davis, professor of veterinary anatomy at Purdue University, is the first human being known to have acquired a cancer hitherto believed limited to birds, and the first known to have contracted cancer from a virus. She is now engaged in an experiment to prove or disprove the association.

"I had worked for years without any special protection against the fowl tumor virus, with my bare hands in contact with the blood and tumors of infected chickens and chick embryos almost daily," Dr. Davis related. "Since my hands were often cut and scratched, I feel almost certain that the viruses entered my body. But perhaps it is just a coincidence. . ."

This saline water conversion plant now supplies water to Guantanamo base in Cuba.

The world's food supply could be quadrupled if low-cost fresh water were made available to arid lands. A remarkable proposal by an American nuclear engineer may provide the solution.

A-power can end the water shortage

by Carl Dreher

FROM the cradle to the grave, about half of mankind is never free from hunger. Tens of thousands die of starvation and deficiency diseases every single day. We have heard this so often that the enormity of it leaves us unmoved. We also know that even if something is done right away to retard the population growth rate (and obviously nothing is going to be done very soon), before the end of the century the population of the world will have doubled—there will be another three billion mouths to feed.

Why is there so much misery on a planet that could be a paradise? The multiplicity of answers covers the whole spectrum of human behavior. But there is also a single

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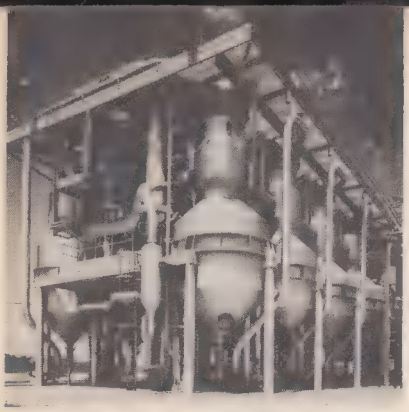


This salt water evaporator at Freeport, Texas is considered one of the most promising water conversion processes. The problem with all plans is high power costs.

physical fact—not enough fresh water where it is needed. About 9 percent of the earth's land surface is cultivated; 36 percent is cultivated but arid. Men are available, machines might be, but water is not. Given low-cost water, the world's food supply could potentially be quadrupled on the basis of area alone.

Large-scale distillation of sea water has been dreamed of for centuries—for reclamation of the Sahara Desert, for instance. The cost of energy has made such schemes impracticable. Now, by the use of atomic power, the prize is within reach. Only, as big businessmen like to say, one must think big. Justice Holmes said that to think great thoughts one must have a heroic mind, and indeed considerable courage is required to think of nuclear power on the scale required.

The particular solution I shall describe is the work of Dr. R. Philip Hammond of the Oak Ridge National Laboratory. Dr. Hammond is a forty-seven-year-old chemical engineer. He was a nuclear engineer at Los Alamos, primarily a weapons center. When his ideas came to the attention of Dr. Alvin M. Weinberg, director of the Oak Ridge National Laboratory and one of the country's leading scientists, he borrowed Dr. Hammond from Los Alamos and set him up at Oak Ridge as head of the Saline Water Conversion Reactor Program. The studies are carried on by a small group of physicist-engineers under the auspices of ORNL and Union Carbide Nuclear Company, which operates the laboratory for the U.S. Atomic Energy Commission.

Fossil fuels vs. nuclear

Hammond reasons that nuclear fuels can show an advantage over fossil fuels (coal, oil, natural gas) only when energy is generated in very large blocks. The jump is one that startles even the engineer familiar with the largest existing power plants and systems. Grand Coulee, which holds all records for production of electric energy over a period of time, has a capacity of slightly under 2 million kilowatts, or 2,000 megawatts (mw). The Soviet Union has a hydroelectric plant at Bratsk, Siberia, on the Angara River, which is supposed to have a capacity of 4,500 mw firm (power always available). The Consolidated Edison system, which supplies all of New York City and most of Westchester, can generate 6,000 mw with every available unit rolling. TVA has a generating capacity of some 12,700 mw, both hydro and coal-

fired, in fifty-six plants, the largest of which is rated at 1,440 mw. Hammond envisions single nuclear plants up to 8,000 mw, or about two-thirds the capacity of the entire TVA system. (All the above are reckoned in terms of electrical output which, in a steam plant, is about a third of heat delivered to the turbines. (Thus an 8,000 mw plant, electrical, would be rated at 25,000 thermal.) Speculation extends to even larger plants.

The economics of the big atom is similar to experience in other enterprises, such as chemicals, aluminum, etc. A few items are "scale-sensitive," others are not. A plant will burn fuel, whether uranium or coal, pretty much in proportion to the energy it produces: this is an example of a component not radically affected by scale, once the design has been set. On the other hand, the cost of manufacture of nuclear fuel elements, the reclamation of spent fuel, the engineering and construction of the plant, the instrumentation, shielding and other safety features—none of these goes up in proportion to size. The bigger you make the plant, the less each megawatt of capacity will cost and the more efficient the operation will be.

For producing electricity alone, plants on such a gargantuan scale as 25,000 mw thermal, 8,000 mw electrical, are out of the question at present. If a power station of ordinary size—a few thousand megawatts—should suffer a sudden failure, the other plants in the system would take over the load. Electrical eggs cannot all be put in one basket; besides, there are few localities that can use such huge blocks of power. There must be another outlet for the heat energy drawn from the reactors. The Oak Ridge program is to study dual-purpose nuclear plants which would wholesale both electricity and distilled water, the distillation being carried on by the low pressure exhaust steam from the turbines (mostly heat that is useless for power generation).

Producing usable water

It is estimated that usable water could be produced in this way at the rate of 1 billion gallons per day for 15¢ or less per 1,000 gallons. One can begin to irrigate at this price and save heavily on municipal use: cities distribute water at 30-80¢ per 1,000 gallons, in some cases higher. The cost might be further reduced by designing the reactors to breed plutonium. With fast breeder reactors, which are in an early stage of development, under favorable conditions water costs might fall as low as 5¢ per thousand gallons. In the Snowy Mountain scheme of Australia, the electricity pays for the water, which is distributed free.

Substantial savings in residential and industrial heating would be a by-product of large dual-purpose plants, since low-cost electricity would compete with price-fixed oil and gas. Any section of the country in which such plants were located would become a low power-cost area. In such an area, as exemplified

by the TVA region, practically everyone heats with electricity.

Low-cost electricity also means low-cost fertilizer. The original purpose of the Muscle Shoals plant, the nucleus of TVA, was to produce nitrates for the manufacture of explosives in World War I; later the nitrates were to be used in the manufacture of fertilizer. Fertilizer plus water is the formula for increased agricultural output. Other chemical and manufacturing processes would also benefit. One envisions great industrial complexes growing up about the dual-purpose nuclear plants.

Billion dollar plant

All these benefits are within reach. In five years a prototype reactor of intermediate size, say 3,500 mw thermal, could be built; in another five years, a plant of 25,000 mw thermal, and so on up. The cost of the big plant would be about a billion dollars, of which a third would be for water, two-thirds for power—this two-thirds being divided between heat for the water section and for the turbines to generate electricity. Such a plant would operate with three reactors, each about twice as large as the ones used for production of fissionable material for weapons at Savannah River and Hanford. No "breakthroughs" are needed in distillation, nuclear power or electrical generating technology. All that the development calls for is an extension of present practice.

The scale of the proposed nuclear plants is too large to be accommodated by existing economic organizations and institutions, yet the potential benefits are enormous.

Typically, society does not adapt its habits and institutions to a new technology until adjustment becomes a matter of life and death for a sizable proportion of the population, and involves qualms of conscience, as well as danger to life and property, for the more fortunate. We now find ourselves in such a situation. It is quite plain that birth control, revolutionary socio-economic changes and large-scale application of nuclear energy will *all* be needed to avert global disaster within the lifetime (if indeed they live) of today's school children. Whatever we do, risk is involved. The risk is greater if we do nothing. It is minimized, in my opinion, if we grasp the nettle and, by adopting the great technology, force ourselves to learn to live with it.

L.B.J. boosts use of A-power

President Johnson mentioned distillation of sea water as one of the advantages that would result from a recent "economic breakthrough" in the use of nuclear power. Speaking at Holy Cross College, June 10, the President said, "The long promised day of economical nuclear power is close at hand." Later in his speech he stated, "Large-scale nuclear reactors and desalting plants offer, in combination, economic electric power and usable water in areas of need."

The machine that plugs itself in

Mod II (left) and Ferdinand (right) search for wall outlets in which to plug themselves in and recharge their batteries. Watching them is one of their designers, John Chubbuck.

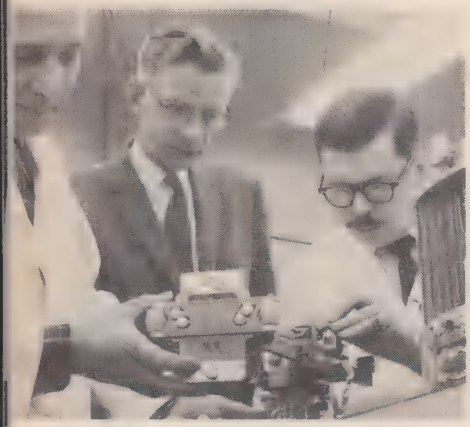
THE hatbox-shaped machine rumbles down the corridor. An engineer flips a switch on the machine and a light on it flashes "hungry." A metal arm with a detector at the end reaches for the wall and "feels" along it. The machine feels its way around an open doorway, reaches a stairwell, backs off safely, and continues down the corridor.

As the detector passes over an electrical outlet, the box stops. The feeler adjusts itself to the outlet. Two prongs glide out and enter the socket. Current charges the machine's battery, and the "hungry" light goes off.

The mechanical hatbox is Mod II built by the Adaptive Machines Group of the Applied Physics Laboratory of Johns Hopkins University.

The Group is trying to produce a machine which could survive in a natural environment (rather than one specifically constructed for it.) The environment in this case is the corridors of the Applied Physics Laboratory.

These corridors provide food in the form of the electrical outlets, obstacles in the form of doorways and various objects, and dangers such as open stairs. The machine must be able to seek out its food, "recognize" it, and "feed" itself. It has to do this by moving, and in so moving avoid being boxed in corners



Disassembled automaton gets an examination from three of the men who helped build it: Left to right: Leonard Scheer, George Carlton, supervisor of the Adaptive Machines Program and William Whitmore.

or hurting itself by a tumble down the stairs.

The mobile automata have met these survival goals with microswitch sensor systems, which simulate the sense of touch.

Mod II is a second generation adaptive machine. The first, less sophisticated, machine was called Ferdinand.

John Chubbuck, Assistant Group Supervisor, outlined possible applications of these experiments: development of a basic behavioral system into which the sophistication of learning might be introduced; and looking further, a sufficiently intelligent automaton to perform exploration in remote or hostile environments, on other planets, or at the bottom of the sea.

In the future, scientists intend to add an acoustic recognition system to Mod II so it can "sound" off the walls rather than just feeling along them. After that will come an optical recognition system so that the machine can identify an outlet plate by the way it looks.

Each new step, adapting the automation to perform another function for its survival, furthers a field about which there is much scientific and popular literature, but little hardware.

In order to operate with any effectiveness, a mobile automaton needs at least a brief memory (to tell it, for example, to stop bumping into a wall long enough for it to turn in some other direction). It also needs to be able to protect itself from danger in its environment.

It is a long leap from a corridor at the Laboratory to the ocean depths or the surface of the moon or Mars. How would an automaton have to adapt to such an environment as another planet? Says George Carlton, head of the Laboratory's Adaptive Machines Group, "You would have at least to make one smart enough not to fall over a cliff."

On Mars, Carlton says, "a basic automaton might, like a child, keep repeating the impression 'red sand, red sand, red sand' while a sophisticated one would note that fact and pass on to another investigation."

It would have to look out for itself. It would take 20 minutes for a signal from men on earth making decisions to reach it, so if it were in any immediate danger any signal from earth would arrive too late.

You've undoubtedly heard how the big oil companies are suppressing news of the substance that, when mixed with water, will replace gasoline in your auto. It's one of the hardiest of . . .

15 myths about inventions

by Stacy V. Jones

THE field of invention and discovery has always been blanketed by an intriguing cloud of mystery. This is partly because inventors, scientists and patent attorneys like to act inscrutable. To give them their due, some of the practitioners of the patent law have denied that it is a black art, and are trying to reform the English in which patents are written.

But today there is a flourishing family of invention myths. Fifteen of the more common are examined here.

Big business buys up and suppresses inventions. The most familiar tales are that a cheap substitute for gasoline or a magic carburetor is being kept off the market by the oil companies. The reports, although seldom committed to writing, are sometimes quite specific.

One legend is that a man offered the Navy in 1917 an additive which, when fed with water into a gasoline tank, could have solved the World War I fuel shortage. Another is that in 1948 a motorist got delivery by mistake of an experimental car that did 50 miles on a gallon.

An inventor must be a salesman. The inertia of industry or of government must be overcome if he is to profit by having his idea sold.

The oil companies, annoyed by the suppression charges, made unsuccessful efforts to trace the rumors. They proved to be as elusive as the inventors of a cheap picture-telephone that the Bell System was said to be withholding and of the everlasting blade that the razor companies were supposed to be denying shavers.

Those who credit such rumors underrate the vigilance of American competition. A couple of smart guys down the block are always on watch. In the case of super-mileage, the myths are particularly unflattering to the intelligence of the motor car industry.

Perhaps now and then somebody does buy up a patent to keep a product off the market. But anyone with 25 cents can buy a copy of the patent and try to "invent around" it—to achieve the same object by means different enough to avoid infringement suits. Inventing around is common practice in such highly competitive industries as oil. At any rate, the patent will expire in 17 years, after which everybody is free to use the invention.

Perhaps the best way to suppress an invention would be to keep it secret—thus foregoing patent protection. But industry has trouble keeping secrets when employees change jobs. And if the problem is important, engineers and chemists in many plants are looking for the answer. The solution cannot be hidden from them indefinitely.

It is safe to say that no valuable invention can long be suppressed.

The Russians pirate our patents. There is no need for Ivan to steal U.S. patents or pay royalties under them. Our government sends copies of our patents to Moscow in exchange for copies of Soviet patents. A U.S. patent cannot be enforced outside the United States and possessions, and a Soviet resident is free to use the invention it describes, unless the inventor has also patented the discovery in Russia.

A number of Americans are reported to have applied in Moscow for Soviet patents. One was granted to Sol Schwartz of Flushing, N.Y., for a machine to wrap high-pile fabrics. Fifteen U.S. patents were granted in 1963 to residents of the Soviet Union, and 50 applications are now pending. An American company is manufacturing surgical devices covered by U.S. patents granted to Russian inventors.

Now and then someone accuses the Patent Office of giving the Russians our military secrets through patent copies. But patents are not

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Reporter Stacy V. Jones has been snooping around the patent office for years. He also writes the column "Science Digest Inventor of the Month."

issued for devices that the Defense Department wants kept secret.

There is an international patent. No such thing exists; a patent is valid only in the country that issues it. An inventor must file wherever he wants protection, although some governments will, upon specific application, recognize a foreign patent. Signatories to the universal copyright convention do recognize each others' copyrights.

The first international or supranational patents have been proposed for the six Common Market countries, but they are some years away.

If you invent a better mousetrap the world will beat a pathway to your door. Now and then some invention is gobbled up by avid industry on the basis of a patent application, even before the patent is granted, but these cases are rare. Usually a high degree of salesmanship is required to promote it. The inertia of industry or government has to be overcome; business has its own staff inventors and usually has heavy investments in machinery.

Dr. J. Herbert Hollomon, Assistant Secretary of Commerce for Science and Technology, says the principal barrier to technological change is not conception of an idea, but getting it introduced. Often it is a matter of invasion. Polymers came from the chemical industry to textiles. Fluorescent lighting came from Europe. The transistor was not developed by a radio tube manufacturer, but in a telephone laboratory.

All inventors are marginal characters, or screwballs. Most successful inventors today are engineers or scientists, and many build their own businesses on their patents. But it's a game anybody can play. Some recent inventions may seem off-beat (to others than the patentees). These include a breath-sweetener for dogs, a dummy bird that fumigates a live bird in a cage, a special burp seat for babies, a combination vest and necktie, and an artificial sow.

Invention comes only through a flash of genius. Sometimes it is inspiration but more often, as Edison said, 1 percent inspiration and 99 percent perspiration. The origin may be accident, daydreaming, long and tedious experiment, or serendipity (the art of profiting from the unexpected). The present patent law says patentability shall not be negatived by the manner in which the invention was made.

One method is exemplified by SR-406, a fungicide invented by Allen R. Kittleson for the Esso Research and Engineering Company. It was named because it resulted from the 406th formula he tried. For contrast there is Du Pont's Vexar, a plastic mesh wrapping for vegetables. An English inventor, F. Brian Mercer, had been seeking a way of extruding such a fabric without any weaving. He awoke from a nap confident that he had the solution. Kitchen and shop experiments proved that he had.

Inventors work secretly in attics. Seven out of 10 patents are issued to corporations whose employees

A patent isn't the answer to all an inventor's problems. He has the invention for 17 years, but the government doesn't go to court for him.

conceived the inventions in large, well-equipped laboratories. The saying that "nothing good comes out of the basement workshop but father," has just enough truth to be amusing. The home inventor is not extinct, but he is becoming rarer. Elaborate tools are needed for most modern technology.

You have to submit a model. The requirement of a model with each patent application was dropped in 1870, although until about 1880 the Patent Office called for them in many cases. Now they are demanded only in the instances of suspected inoperability, such as perpetual motion machines.

Patent models were a major Washington tourist attraction in the nineteenth century. A few are on display in the Patent Office, and the Smithsonian Institution has a number of historic significance, including Abraham Lincoln's Device for Buoying Vessels Over Shoals (1849).

No perpetual motion machine has been patented. A number of patents have been granted abroad for perpetual motion (*perpetuum mobile*) devices. In this country, several such patents are reported to have been issued before 1836, when the examination system was adopted, but records for that period are scant. Although the traditional policy has been to reject all applications for mechanical impossibilities, at least one such machine got by the examiners more recently.

In 1882, Patent No. 257,103 was granted to John Sutliff, Sr., of Huntsville, Mo., for a motor. The drawings show a hollow bulb immersed in a tank and attached by a shaft to a cogwheel, a box holding a rolling ball, and a bellows. Sutliff did not call his contraption a perpetual motion machine, but he omitted any source of power, and his description implied that the parts kept each other constantly clanking and chuffing around.

Certainly you won't get a perpetual motion patent today. When such an application is filed, the examiners try to get the inventor to take back his fee and forget it.

You just file a paper and get a patent. First there is a search among the 3,000,000 U.S. patents, by you or your attorney, to find out whether your idea is probably new. Maybe the Patent Office won't agree anyhow; it grants only about three out of five applications.

The average waiting time for a patent is a little over three years. Some disputed cases take much longer. An important patent on the automatic choke, disputed by several motor companies, went to General Motors Corporation after 23 years,

2 months, and 28 days. The minimum cost of a simple patent is several hundred dollars.

You have nothing to worry about, once you get a patent. The American law gives the patent owner the right to exclude all others from making, using or selling the invention for 17 years. But he has to do the excluding; the government doesn't go into court and fight his battles for him.

Although the patent owner enjoys a "presumption of validity," somebody else may be able to upset his temporary monopoly by proving in court that he invented it first. Alexander Graham Bell and his associates had to protect the telephone in more than 600 infringement suits.

All you need for an invention is one patent. The Du Pont Company has more than 40 patents relating to Corfam (the new poromeric material being introduced for shoe tops) and to the processes and equipment used in its manufacture.

Your attorney or somebody in the Patent Office will steal your idea. Such tactics would cause an attorney to be barred from practice or get a Patent Office employee fired. Employees of the agency are prohibited from owning any interest in a patent.

The Patent Office staff, by regulation and long tradition, is extremely close-mouthed. Nothing in an application is revealed until the patent is issued. This writer has been snooping around the Patent Office as a reporter for years, and nobody has leaked any secrets to him.

Only 5 or 10 percent of issued patents have any value. Many do indeed come to nothing. But studies by the Patent, Trademark and Copyright Research Institute of George Washington University indicate that more than half the inventions patented in the United States are used some time before the patents expire.

A Senate committe published in 1961 a list of 80-odd inventors, compiled from court records, who had received a total of more than $10.3 million in royalties. Most of them were independents—that is, not corporation employees. The cases were above average in revenue, big enough to get their principals into litigation, but show that invention can be profitable.

The head of the Patent Office quit some time in the 1870's because everything had already been invented. The source of this hardy legend is a paragraph in the annual report of the Commissioner of Patents for 1843: "The advancement of the arts from year to year taxes our credulity, and seems to presage the arrival of that period when human improvement must end."

This was a mere rhetorical flourish to emphasize the rapid progress of invention 120 years ago, as the context of the report shows. The author, the Hon. Henry L. Ellsworth, was far from stupid. He was the son of a U.S. Supreme Court Justice, a graduate of Yale, and an experienced administrator. He did not quit until 1845, after which he went west and made a killing in real estate.

INSIDE PSYCHIATRY TODAY

Psychiatry looks at courtship

Flora Rheta Schreiber and Melvin Herman

COURTSHIP, that unexplored phenomenon of late adolescence and early adulthood, has at last received a first nod of psychiatric investigation. It comes from Bruce H. Sklarew, M.D., of The National Institute of Mental Health, Bethesda, Md.

His study "Courtship—The Origin of the Family" is only a pilot effort dealing with 25 native-born, middle-class college students at various stages of commitment—going steady, seriously considering marriage and formally engaged. But it raises important issues.

One important dynamic of this thorny time, the study clearly reveals, is one's image of oneself—in particular the level of one's own self-esteem. The male animal, with a hard protective armor of this valuable commodity, tends to see reality and see it whole, while his potential spouse, who is typically less sure of herself, dresses reality up in a variety of guises. While the man is likely to see his bride as she really is, she tends to surround him with a halo of over-idealization. This tendency to over-idealize her man is also likely to stand in the woman's way of making identification (achieving empathy) with him in times of crisis. Conversely, his lack

of idealization of her enables him the more readily to achieve empathy with her at these times.

Uncertain of herself, she looks for reassurance that she is loved. Finding this assurance when, from "going steady," the couple seriously contemplates marriage, she experiences an upsurge of self-esteem. For the man, however, this upsurge comes later, only after marriage plans are definite and he can dig his teeth into the practical business of making arrangements.

The courtship, of course, can end in parting rather than in marriage. This usually happens for predictable reasons. Empathy at moments of crisis has been notably absent. Or the couple neurotically has chosen each other for masochistic reasons rather than for any basic affinity that would result in each one's complementing and reinforcing the other. Or there has been in one or both partners the absence of the need for affiliation.

Significantly this need for affiliation tends to be greater among men and women who were either the first child in the family or an only child. "Having more likely experienced infantile satisfaction in an exclusive parental relationship," says Dr. Sklarew, "these first and only children seek a repetition of this gratification with a partner."

The breakup of a courtship, less publicized though it is than the breakup of a marriage, can also have serious consequences, particularly in the sensitive area of establishing one's sexual identity.

Further investigation is needed to establish quite specifically what are the consequences of this loss of sexual identity and what practical means can be taken to keep it from perverting and destroying future relationships, either by leading the jilted partner to eschew marriage altogether or to contract a later unsuitable marriage through sheer desperation.

Further research is needed, too, to define the differences in male and female self-esteem and the different capacities of men and women both for empathy and over-idealization. The sexual differences in this limited sampling seem too sharp to tally with general observation. We have often seen the male who is cool, detached and incapable of empathy and the female who gives herself to full identification with her partner. It is also possible that the over-idealizing woman may be investing her partner with a halo, not because she thinks the less of herself, but because the halo is the fullest expression of her intense feelings for him.

Courtship is a crucial phase of late adolescence and early adulthood. The Sklarew study will shed further light on the problems of this period.

A new view of schizophrenia

Not long ago, Dr. Murray Bown, a Chevy Chase, Md., psychiatrist and one of the pioneers in the new school of psychiatry known as family therapy, told the annual meeting

Talk can destroy. A child who becomes schizophrenic has parents who talk differently from others. Their words are garbled and frustrating to the child and they leave him a legacy of conflict and doubt.

of the American Orthopsychiatric Association: "We must ask, 'Is the patient schizophrenic, or is the family schizophrenic?' We are only beginning to face up to the implication that the symptoms of the so-called patient are manifestations of family problems."

Today, as revealed by two important new studies, one at Yale, the other at the University of Texas, we are facing up to another startling discovery about the nature of schizophrenia. It is that schizophrenic families have distinctive language patterns and that these patterns, moreover, play an important role in causing the illness.

A child who later becomes schizophrenic has parents who talk differently from other parents. For instance, mothers of schizophrenics, who were studied in contrast to mothers equally disturbed, though non-schizophrenic children, had language patterns that were altogether distinct. The mothers of schizophrenics spoke like each other and their language failed to communicate. They did not, however, speak at all like mothers of other disturbed children.

Parents of schizophrenics typically garble their messages in such a way as to leave their children puzzled and in a state of conflict. Consistently these children are denied the pleasures of sharing simple direct meanings with their parents. In a curious, baffling and altogether frustrating way, the parents, because of evasions, fears and conflicts, actually block the child's words and train of thought through what Dr. Kisik Kim of Yale calls "disruptive speech intrusion." Note, for instance, the following conversation, illustrating such intrusion:

Mother: Take your pills when they tell you to. Work along with them. Cooperate. Right?

Son: Just that I didn't feel. . . .

Mother (interrupting): What?

Son: All the time that. . . .

Mother (interrupting): Feel free, feel free to talk, Johnnie!

Son: All the time that I got. . . .

Parents also accomplish this blockage through sudden, startling shifts through which they deny in a second breath what they uttered in the first. Note, for instance, the shift in a mother's thought during her conversation with H. F. Searles, a British psychiatrist. "He was very happy," she said of her son Edward. "I can't imagine this thing coming over him. He never was down, not ever. He loved his radio repair work at Mr. Mitchell's shop in Lewistown. Mr. Mitchell is a

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very perfectionist person. I don't think any of the men at his shop before Edward lasted more than a few months. But Edward got along with him beautifully."

Then came the shift that nullified everything she had said before, as she added, "He used to come home and say (the mother imitates an exhausted sigh) 'I can't stand it another minute.' "

Family conversation in such a setting becomes a weapon of frustration in an arsenal of tangled emotions. For the interruptions, the sudden shifts, are more than chance occurrences. They are, rather, the expression of conflicts and anxieties that in turn spur new conflicts, new anxieties in an endlessly self-perpetuating chain of psychosis.

By failing to provide simple direct expression, these parents do not prepare their children for normal adult communication. The result is that the moment these children, even when they become adults, are confronted with complicated or disturbing language, they blur and retreat.

The current psychiatric opinion is that, for this reason, schizophrenic patients suffer from a severe inability to interpret messages from the outside world. Further, this is regarded as likely to be less a biological abnormality than the result of many years of exposure to inadequate communication in the home. The deprivation, moreover, is not only a matter of words, but also of feelings, of a longtime situation in which parents and children were isolated from each other because there was no expression of what was really felt. This lack of clear communication is regarded as quite probably a defensive effort to cloud rather than to elucidate feelings, as the University of Texas study puts it, "in the manner of the defensive tactics of the squid who fills his environment with murky indistinctness to avoid harm."

Yet the harm is there—deep and insidious. The new findings about the language of schizophrenic families, however, suggests new therapeutic methods for coping with that harm. The trend is to adopt therapeutic procedures that place great emphasis on simple, direct, unambiguous communication from therapist to patient, whether it is an individual patient or the whole family seen in family therapy.

Outstanding psychiatrists like Sullivan, Fdern, Searles and Rosen have stressed that the best way to establish and maintain a relationship with schizophrenic patients is to be simple and repetitive. It is now believed that the schizophrenic, suffering from long exposure to meaningless, incomprehensible human communication within his own family, can best be treated by increasing his store of solid and relatively unequivocal information about the feeling and meaning of the therapeutic process. As the University of Texas study concludes, "It is thus possible to conceive of a closer tie between a theory of causation and a theory of treatment of the schizophrenic patient."

Disturbed adolescents

A project in preventative psychiatry conducted in New York City by St. Luke's Hospital, the Department of Psychiatry of the College of Physicians and Surgeons of Columbia University, and Horace Mann School has demonstrated that it is possible to predict a student's failure—not only academic failure, but also emotional and behavioral failure. The prediction is effected through a simple chart which requires only a few minutes of time to score. The scoring is done by four different teachers to balance the possibility of biased impressions. The predictions, it has been clearly shown, can be made with a high degree of accuracy at the end of the first quarter of the ninth grade when the children are passing through early adolescence.

Far from being an idle academic procedure, these charted predictions have proved to be a call for help at a time when help can do most good. Help to the youngster at this time can prevent the development of the disturbance underlying the predicted failure from growing into a full-blown mental illness. Faced with the evidence of the chart, both parents and teachers not only understand the child's problems better, but are also in a better position to change their attitudes towards him. At Horace Mann, a Mental Health Workshop in which both parents and teachers participate spurs such change. It is, moreover, this combination of early prediction and of a workshop for changing attitudes towards disturbed children that constitutes a practical technique for nipping mental illness in its earliest stages.

Why is dirt so dirty?

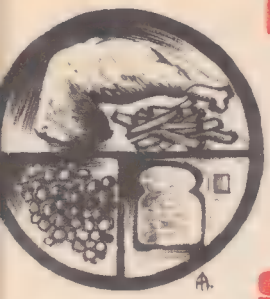
A BOULDER can't stick to the ceiling, so what is the force which can hold a microscopic speck of the same material up there? And what are the forces which hold dirt on the floor against the pull of a powerful vacuum cleaner? Or keep dirt in a shirt in the wash?"

These are some of the questions asked by Alan B. Draper, assistant professor of industrial engineering at Pennsylvania State University. He is going to try to answer them in a study under an $11,600 grant from The Singer Co., Denville, N.J.

Some of the known forces, according to Draper, are: entrapment within pores, such as grains ground into a linoleum floor by a woman's spike heel; electrostatic attraction, like a balloon which, being stroked with fur, will stick to the wall; chemical bonding, or the exchange of electrons between the surface material and the dirt, and surface tension between liquid films on particles and the solid surfaces.

In his experiments Draper will be using a special blend of synthetic dirt, made of hair, rubber, milk, tobacco, and "just about everything found in household dirt."

Dirt, says Draper, is "matter out of place."



DINNER IN 90 SECONDS

Within the next few years almost every food item in our supermarkets will be radically different.

by Willetta Bar-Illan

WHEN you buy your next refrigerator, or stove, or freezer, you will be buying an appliance that will soon be obsolete.

The world is undergoing a great food revolution whose effects will be as far-reaching as they are unpredictable.

Even in the past 20 years, the culinary habits of America have changed dramatically. Almost 50 percent of the grocery products sold today are entirely new items, and another third consists of items that have been basically and thoroughly changed in the last two decades, from frozen foods to pressure-packed whipped creams.

But that's just the beginning. Here's what's to come.

Irradiation: Irradiation of food is the most dramatic, most revolutionary and potentially the greatest life saver of the new developments.

What is irradiation? It is, except for canning, the only completely new method of preserving and processing food ever developed. Like canning, it is a comparatively simple process. The isotope Cobalt-60 emits a highly penetrating gamma ray. By bringing a food product close to the cobalt, the gamma rays pass through the food, destroying the microorganisms which cause spoilage. There are now two systems of food-irradiation—the high dose, which employs 4 to 5 million radiation units (rads), and the low dose, which does not go beyond the range of 300,000 rads. The difference between them is similar to the difference between sterilization and pasteurization. High-dose irradiation kills off bacteria and permits foodstuffs to be kept in room temperature, provided they are properly packed, for months or even years without spoilage; low-dose ir-

Irradiation may make it possible to send meats on a slow trip anywhere in the world and encourage meat producers in countries with little refrigeration.

radiation reduces the bacterial count and triples the storage life of fresh foods under normal refrigeration.

There are still some "bugs" in the process: in some cases, irradiation can alter the taste, odor, flavor and texture of the food. Right now, the main goal of Army researchers and the commercial laboratories that are developing this process is finding the "right" dose for each given product. Proper packaging—essential for the prevention of recontamination—is another problem not yet completely licked, and the Army is now doing research that should result in economically acceptable, efficient, flexible packages.

Meats: Last year (Feb. 1963), the Food and Drug Administration cleared for unrestricted public consumption fresh bacon sterilized by irradiation. Other irradiated meat items, particularly chicken, are likely to be available soon. *This means that all meats could be stored in room temperature for years without spoilage;* it means that meats can be carried on a slow boat around the world without refrigeration; and, perhaps most important, it means that the farmer in the underdeveloped, under-nourished country, where refrigeration is now almost non-existent and prohibitively expensive to install, will have an incentive to produce meat. (At present, no such incentive exists, simply because whatever he raises will be spoiled before it gets to the consumer.) Since animal protein is the most commonly missing factor in the diet of the two billion undernourished people in the world today, the irradiation of meat promises to be one of the most effective means of closing the nutrition gap.

Fish: Seafood cannot yet be subjected to large doses of radiation without loss of texture and flavor. But a very moderate dose "pasteurizes" it, and extends the refrigerated storage life of even such perishable items as king crab and shrimps four and five times without any unfavorable effects. When ground was broken in Gloucester,

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Massachusetts, for the first irradiator designed for pasteurization of food, a luncheon of pasteurized soft-shell clams, finnan haddie and haddock was served to the assembled dignitaries. No difference between the fresh and the pasteurized product could be noticed. In fact, the delicate, fresh taste of sea food—unattainable in any other preservation method—was preserved by irradiation in ocean-fresh condition. As a result, the expansion of the fresh-fish market to all inland areas is at hand; fish will be inexpensively available almost anywhere in the world.

Poultry: In Army experiments, sterilization through high radiation doses has been successful to the extent that the product remained fresh for over two years at room temperature. For economic considerations in commercial use, low-cost, low dose pasteurization would be more practical, and FDA clearance for general marketing is expected soon.

Vegetables: One of the lowest doses of radiation, 8,000 rads, is a highly effective sprout inhibitor in such foods as potatoes and onions. Treatment at this dose has extended the storage life of a dozen varieties of potatoes to a year or more, and eliminated the until-now, inevitable losses due to sprouting. At the end of the storage period they were successfully processed into frozen French fries, potato chips, instant mashed potatoes and prepeeled boiling potatoes. The Atomic Energy of Canada Ltd. operates a trailer with a mobile irradiator which treats the potatoes at the farms, thus saving the cost of transportation to a central plant. The operation has been in a commercial stage in Canada since 1961. In Belgium such produce as peas, beans, mushrooms are blanched for a short time, then packaged in cardboard boxes lined with polyethylene bags, and then bombarded with 50,000 rads. They stay fresh for at least three months at a temperature of 40°.

Fruits: The possibilities of pasteurized fresh fruit are similar to those of fresh fish. By extending their shelf life even a week or two, they can be made more widely available. The shelf life of fresh strawberries, for example, can be extended by seven weeks without change in flavor qualities. This means that cross-country shipments without refrigeration will be possible. The rate of ripening of most other fruits can also be retarded through low-dose irradiation.

Milk: High-dose irradiation sterilizes milk to the extent that it can be kept at room temperature as long as normally-pasteurized milk can now be kept fresh under refrigeration. However, the AEC says that some "bugs" in the process must be eliminated before it can be released for commercial use.

It will probably take about five years for irradiated food to get to the consumer's market. This depends not only on the industry's speed in adopting production methods, but on the speed with which an important psychological barrier can be overcome. There is a conno-

tation of danger that is associated with radiation, and before irradiated food can become popular, the public will have to realize that there is no relationship between the beneficial result of food irradiation and the deadly danger of fallout. Dr. Edward Josephson, director of the U.S. Army Radiation Laboratory at Natick, Massachusetts, where most of the research in this area is taking place, asserts, "There is no scientific basis to suspect that Cobalt-60 irradiation of food can be harmful. There is no after-effect for the simple reason that the radiation has passed on through, and the foods are in the same condition as heat-processed canned foods are after being subjected to heat. When you pull a can off a shelf there is no heat in that food. Similarly there is no radiation in foods treated by irradiation." In extensive experiments carried out by the Army, Air Force and the AEC, in which more than 300,000 laboratory animals and thousands of humans have been fed irradiated food, no ill-effects or abnormalities were recorded—even though the amount of irradiated food consumed in the experiments was of enormous quantities.

✔ **Antibiotics:** The use of antibiotics in the preservation of food gained official recognition as far back as 1945. In this process such antibiotics as oxytetracyclin and chlortetracydin are inserted into, or sprayed on, foods to prevent undesirable chemical reactions during storage. Today, the U.S. Food and Drug Administration permits the use of antibiotics in preserving dressed poultry, and their use may be extended to the preservation of meats and fish. Control of spoilage of cream of chicken soup, tuna and noodles, cream-type corn and chow mein was investigated at the American Can Company. It was found that through antibiotics the spoilage that results from microorganisms invading the foods can be retarded by at least one year. Future application of antibiotics is expected in machine vended food.

✔ **Freeze drying:** The removal of water from a product after the product has been frozen is called freeze drying. The water passes off as a gas, leaving a sponge-like structure which has lost 85-90 percent of its weight, but not its bulk, with excellent rehydration and flavor characteristics. The products are dried in a vacuum chamber at very low pressure by the controlled input of a small amount of thermal (300-350°F.) or microwave energy. When placed in water the foods resume their original shape and flavor. Products processed by this technique can be marketed and preserved for a practically unlimited time, in any climate, *without refrigeration,* with only a plastic pouch to protect them from spoilage, and can be shipped and handled more economically because they are lighter. The following are some freeze-dried products available or projected: shrimp, crabmeat, lobster, beefsteak, hamburger, pork chops;

Lobster, potatoes au gratin, and mushrooms are some of the many delicacies that can be preserved by freeze drying.

ham and potatoes au gratin, mushrooms, noodles, vegetables, diced chicken and other ingredients for dried soup mixes (of which Campbell's Red Kettle series is already on the market); ham and chicken, shrimp creole; cottage cheese and several kinds of fruit. Freeze-dried coffee has been placed on the market by General Foods, and with its superior flavor it promises to replace instant coffee.

Freeze drying is particularly advantageous for specialized products in which high flavor retention is a must, such as fruit ingredients for gelatin desserts and puddings, cake mixes and ready-to-eat cereals. General Foods is now test-marketing corn flakes with freeze-dried strawberries in the package.

Dehydro-freezing: The dehydro-freezing method, sometimes called dry freezing, involves the removal of water from the product *before* freezing. Already well advanced, this technique consists of dehydrating the product to a low moisture content, then quick-freezing it. To avoid undesirable changes, drying is accomplished with the least possible heat, which considerably lessens the danger of cellular damage during freezing. The resulting product is not only lighter in weight but smaller in bulk, and offers the increased advantage of savings in freight and storage space, but it is marketed and preserved frozen. Already commercially available are dry frozen peas, diced carrots, diced potatoes, apple slices, whole potatoes, figs and pimentos.

"Instant" foods: Dehydrated or "instant" foods have been known in the American market since the war, but many new products have been added recently, and there are more to come. Apple pieces processed through conventional drying and "explosive puffing" will be in commercial use soon. The puffing process imparts a crispness and retains taste better than the conventional dehydration. It also enables the pieces to reconstitute when simmered only 2-5 minutes. The product can be used as a dry cereal, baking mixes, compotes, pie fillings, etc. Apples are but one of the many fruits and vegetables that can be dehydrated in piece form, subjected to explosive puffing, and then readied for eating by a few minutes simmering. Others that have already been so prepared are potatoes, sweet potatoes, carrots, beets, rutabagas, green corn, beans, peas and lentils.

The cooking processes will undergo a face lifting too. A microwave oven can broil a steak in only a few seconds.

The puffed bean powder, for example, can be used not only as soup but as fried bean cake, dips, croquettes, casserole, stuffing, etc.

"Instantized" flour, introduced by General Mills to the consumer market, heralds greater processing ease for use in flour-thickened recipes, in sauces and gravies. It has uniform granular texture, mixes easily with water and pours evenly and quickly.

In Japan a highly nutritious "instant" milk powder for infant feeding is being widely produced. It is the best known substitute for human milk. The powder is processed from cow's milk, with additives of lactose, vitamins, iron calcium and reduction of ionic components (Chloride, sulfate and nitrate considered harmful to the infant's kidneys, are eliminated.)

New cooking devices: The microwave oven, now in use in many modern restaurants, will be a common feature of the home kitchen within a few years. It can broil a steak in a few seconds or a complete frozen meal in two minutes.

The boilable bag—*i.e.* the frozen food preparation contained in a plastic bag which can be dropped in boiling water to reheat, or to complete the cooking of the contained ingredient, is now making a major breakthrough. Next year, 400 million units—ranging from filet mignon to fruit soup and to rice pudding—will be on the market. The plastic bag not only retains the taste and flavor better than other packaging, but eliminates the need for cleaning pots and pans.

Other innovations in packaging include cook-in cans for such dishes as spaghetti and beans, and oven-ready casserole-cans for prepared meals (the opened container is placed in the oven, used as a serving dish and then discarded.) The most revolutionary ideas are directed towards edible packaging—a container that would be eaten with the contained ingredients. A bread cup —a truncated cone that can hold about 5 oz. of hot or cold food without getting soggy, is being introduced in drive-ins, and being studied for a marketing device.

New foods: The more efficient preservation, the wider and cheaper distribution, and the easier preparation of existing foods will raise the American standard of living and will serve as an indispensable weapon in humanity's fight against hunger. But the comparative slow-

ness and precariousness of today's food-growing methods make it necessary to think in terms of totally new foods as well. It is not a new thought. The creation of tasty, nutritious and inexpensive synthetic foods has been man's dream ever since his first crop failure. Now, several new developments promise to turn this dream into reality.

Of these, soy-protein products are the most important nutritionally. And because they lend themselves to taste-additives and to shaping in forms of different foods—they are also the most attractive. The product can be manufactured in any shape: from dry fruit and potato chips to vegetables, and from nut kernels to rib roasts. What's more, it can be made to taste like what it appears to be. Recently Worthington Foods Co. served spun soy protein rolls resembling chicken, ham, sausage, and dried beef to veteran food processors and packers. In texture, color, taste and appearance they were so similar to their meat and poultry counterpart that almost every one of the tasters was thoroughly deceived.

The first commercial applications of the Worthington products, Ralston Purina's edible spun soy protein fibers, are making their appearance in two frozen packages: Fri-Chik, a fried chicken-type product, and White-Chik, a sliced white meat type product. In the American market these foods will provide low-fat, high protein food to people whose religious beliefs or medical condition prevents them from eating meat or certain types of meat. For the undernourished, whose diet is chronically deficient in proteins, it can be used in powdered form as an inexpensive but vital food additive.

The new discoveries in synthesizing flavor will make it possible to lend an attractive taste not only to spun soy-protein but to many other sources of nutrition. It makes, for example, the possibility of farming the sea for plankton and algae, both rich sources of protein, less remote than it had been. Nabisco, which has been remarkably successful with synthetic flavoring is now marketing crackers with beef flavor and with chicken flavor. If algae can be made to taste like filet mignon, there is no reason why it should not be accepted not only by the hungry, but even by the most spoiled palates. As for the unpleasant association of their "vile" origins, the potato too was considered unfit for civilized use when it was brought to Europe from South America 300 years ago—but it is doing quite well now, thank you. With medical discoveries increasingly pointing to the danger of meat-fat, these fatless sources of protein may become desirable even in the well-fed countries where meat is abundant.

Another protein-rich source being studied—particularly by UNICEF—as a potential synthesized additive for protein-deficient areas is cottonseed.

In Guatemala, a protein-rich food, dubbed "incaparina," has been successfully developed from corn meal, sorghum, cottonseed flour, torula

yeast, vitamin A and calcium carbonate (slaked lime.) Except for the vitamin A, all the ingredients are abundantly available locally. The new food is in the form of a powder which has a neutral taste. It has performed miracles in saving the lives and improving the health of the under-nourished native children.

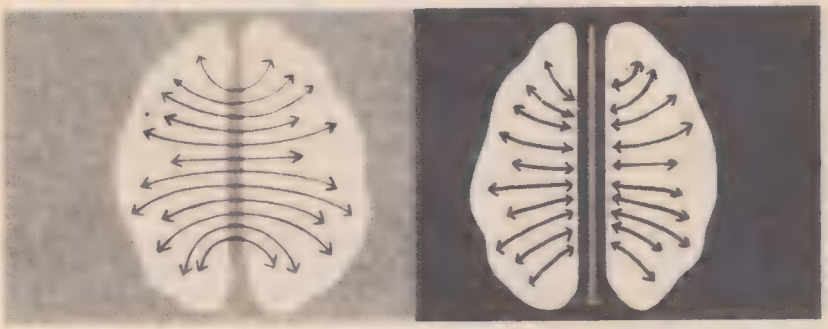
Recently Esso Research announced that their processes for making food from petroleum had progressed to the pilot plant stage of development. The product is a dry white powder that resembles powdered milk. Like dried yeast, the product is made up of microorganisms. British Petroleum reports that the food they have developed from petroleum has a protein content of 50 percent and all the amino acids known to be essential for animal and human nutrition. In addition it contains substantial qualities of the B vitamins. Animal feeding studies have shown that the product compares favorably with more conventional high-protein feed supplements —such as dried yeasts and fish meal. Both Esso and British Petroleum intend to develop the product as a dietary aid for humans.

To the affluent American housewife, the great food revolution will bring a drastically changed kitchen and the kind of leisure and convenience that were unimaginable even ten years ago. With a flick of the wrist and in 90 seconds she will be able to serve anything from chicken tetrazzini to baked Alaska.

And it will mean that, after 6,000 years of striving, man may be able to defeat his oldest and most indomitable enemy: hunger.

"All systems are go—prepare to launch—!"

Why we have two brains



The two halves of the brains of animals and men can and do operate independently of one another. A young Maryland researcher is probing the mechanisms that make this possible.

by Katharine B. Mishler

As soon as the small door on one side of the training box was opened, the chimp inside reached out swiftly with his right hand, felt for the door of the food box that he could not see, expertly undid several kinds of latches and a chain, opened the food box and seized the fruit within. Time: six seconds. When the laboratory assistant opened the corresponding door on the opposite side of the training box, the chimp's behavior was very different. His left hand reached out exploratively, but his fingers moved uncertainly over the food box door, fumbled with the latches, gave up. Obviously his left hand didn't know what his right hand had been doing.

"With this setup," said Dr. Ronald E. Myers, "the chimp can't see the food box from either door, so he gets no help from his eyes. Still, a normal animal who has been trained to open the latches with one hand will do about as well with the other even on the very first trial. This chimp is a 'split-brain' animal. The major connections between the two hemispheres of his brain have been severed, so what one hemisphere learns is not transferred to the other. We can teach him how to open the box with his left hand, but we'll have to start from scratch."

I was visiting Dr. Myers at the Laboratory of Neurological Sciences,

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Ten years ago no importance was attached to the fibers connecting the halves of the brain. Then a scientist decided to separate the halves.

adjacent to Spring Grove State Hospital, Maryland. Dr. Myers, Ph.D. and M.D., is a neurophysiologist and clinical neurologist, whose special interest is the cerebral basis of perception, learning and memory. He is one of the leaders in investigating the question why man and most animals have, in effect, twin brains, connected and working together, but capable of working separately. The studies for which he is best known are those with "split-brain" animals of the kind I had been watching. At the California Institute of Technology in 1953, when he was only twenty-three, he performed a series of experiments that led to a revision of theories about the relationship of the two halves of the brain.

At that time, the brain's *corpus callosum,* a massive bundle of fibers connecting the two hemispheres, was not thought to have any significant function—at least none had been detected. Severing the fibers seemed to produce no effect at all, either in animals or in the few people on whom the operation had been tried with the hope of controlling epilepsy.

But Dr. Myers believed careful study must reveal some evidence of change. In his experiments, which were done on cats, he first cut through both the corpus callosum and the *optic chiasm,* that narrow bridge over which visual impulses flow from each eye to the opposite side of the brain. When healing had taken place, he put a patch over one eye of each "split-brain" cat, and trained the other eye to discriminate between certain different patterns. He then tested the cat through the untrained eye. With the trained eye closed, a split-brain cat had no memory whatever of the visual discrimination it had learned.

Which eye was open

Dr. Myers' next step was to show that his cats could be trained to respond to the same visual patterns in two conflicting ways, the response depending on which eye was open. For example, a split-brain cat might be trained so that with the left eye open it would push at a door with a horizontal pattern to get food, whereas with its right eye open it would push on a door with a vertical pattern. Studies of a control group confirmed what common experience would lead one to believe—that, in contrast to the split-brain cat, a normal animal transfers training received through one eye to the other, with little or no loss of memory. It became clear therefore that the corpus callosum is necessary for one side of the brain to communicate with the other, at least on certain levels.

Generally, in just about the amount of time and trials needed by a normal monkey to learn to respond to one visual stimulus, the split-brain monkey can learn to respond to two conflicting ones. Its two hemispheres have separate memory systems. What happens, I asked Dr. Myers, when the animal has to make a choice, with both eyes open, between conflicting patterns of response? With little delay one hemisphere or the other takes over completely, the response depending on such things as which side the animal habitually favors or which response is handiest.

Many studies have been made, by Dr. Myers and others, to determine that different parts of the corpus callosum transmit different kinds of information—motor, visual, tactual, and so forth. Now it is believed that the fibers connect brain centers in one hemisphere symmetrically with corresponding centers in the other. It is possible to predict fairly accurately what effect the severing of any one section will have on an animal's ability to transfer a particular kind of learning.

Dr. Myers feels that even the most distinctive functions of the human brain may have their base in the same mechanisms of learning and correlating as the monkey's. The corpus callosum may, in humans, serve the same purpose as it does in animals, and place its own structural limitations on human mental activity. It may, for instance, contain the answer to the puzzle of the dominance of one hemisphere in human beings. Researchers have established in recent years that speech centers are generally in one hemisphere only, usually the left, whether a person is right- or left-handed. There is no hemispheric dominance of this kind among animals, though they may show a preference for the use of one side.

How and why has the human brain developed an organization in which speech memory traces or engrams are confined to one hemisphere? Why are they not transferred through the millions of fibers of the corpus callosum to lay down duplicate traces in both halves of the brain? Dr. Myers suggested that it may be because the symbolic processes underlying speech, which involve various brain centers, are too complicated for their patterning to be conveyed adequately through the corpus callosum, and the brain has no better mechanism for cross-transfer.

After surgery, what?

We talked about other puzzling questions that relate to this. Why does stuttering sometimes follow a change of handedness in a person? Can functions be transferred from one hemisphere to the other after a person has had a stroke or has had part of the brain removed by surgery, as in treating epilepsy or tumor?

Studies have shown, Dr. Myers told me, that in animals, and probably in humans, there are great in-

dividual differences in the ability to transmit information through the corpus callosum. He raised the question whether this has any relationship to the development of handedness or ambidextery in people. Do ambidextrous people have better developed transcallosal communication than others? And if they do, is it early use of both hands that produces better development of the corpus callosum, or do the basic characteristics of the corpus callosum produce ambidexterity? If it is true, as some educators believe, that ambidexterity is often accompanied by learning difficulties, is this because the well-developed corpus callosum permits the transmission of too much conflicting data?

Flashing the message

"It's become clear," Dr. Myers said, "that the corpus callosum is necessary for transmission of complex data from one hemisphere to the other. Yet very simple messages find their way across by some other means. For instance, a conditioned response to a flashing light will survive midline severance of all structures of the brain down to the brainstem.

"The most impressive thing in exploration of brain functions is how flexible the organization of the brain is, how little in brain functions is mandatory. The brain is highly organized topographically, with clear localization of function, yet in most cases it doesn't matter how much of a functional sector you destroy. As long as you don't destroy the whole thing, there is little effect on perception or behavior. You find yourself more and more amazed and curious."

A useful purpose?

Was severing of the corpus callosum of humans ever likely to prove useful? Dr. Myers was cautious. He referred me to the studies in the early 1940's by Dr. Andrew J. Akelaitis (then at Rochester) on a number of epileptic patients whose corpus callosum was severed by W. P. Von Wagenen in an unsuccessful attempt to help them. "These patients," said Dr. Myers, "showed no essential change in mental condition, alertness, or social behavior, and no change in perceptual or motor capacities under the tests then used. Unfortunately, there was also no relief from the seizures. However, there has been a revival of interest in the possibilities of this kind of surgery, and one recent report describes a patient whose seizures appear to have been ended by separation of the two hemispheres."

Current projects at the Laboratory include further studies of the function of the corpus callosum and its relations to handedness, and studies of localization of function within the hemispheres. Dr. Myers will have the opportunity to study a variety of related questions on the function of the human brain in the course of his work with selected patients from Spring Grove State Hospital.

NBC photo

The Hugh Downs Column

What happens if an irresistible force meets an immovable object? If a tree falls in the forest and there is no living thing with ears to hear it, does it make a sound? Can electronically reproduced sounds be . . . .

BETTER THAN REAL?

CAN electronically reproduced sound be "better" than the real thing? The question is not as silly as it may seem.

Scientific "puzzles" still circulate among the lay public, but many are not real puzzles at all: that is, they do not admit of a scientific solution but rather of a semantic solution. They are puzzles of word meaning rather than science. Here are two examples which I hear debated with more frequency than a proper understanding of them would allow. I might still be puzzling over them too if my father hadn't made them vanish for me when I was very young by throwing the cold water of semantic clarity on them.

The first one is "What would happen if the irresistible force met the immovable object?" Until it is understood that this is a meaningless question it is very puzzling indeed.

Imagine the complexity of a record groove for a one-hundred-piece orchestra recorded with a solo voice and a choir and a pipe organ.

A force of infinite strength pitted against an object of infinite mass. There are two possible outcomes: the immovable object is moved, or the irresistible force is resisted. Either alternative is untenable.

In regarding the question as very large, we overlook the solution, which is right under our noses since the whole problem is tiny, not large. The problem is of words, not physical principles. The two terms of the problem are by definition mutually exclusive. If an immovable object exists, this automatically precludes the existence of an irresistible force. If, on the other hand we suppose the existence of an irresistible force, it must be by definition capable of moving *all* conceivable objects. So the solution lies in examining the problem, finding it false, and dismissing it.

The other puzzle has to do with the definition of sound. "If a tree falls in the forest and there is no living thing with ears to hear it, does it make a sound?"

Without getting into Berkeley's argument about the reality of anything apart from the concept of it in a living mind, let's look closely at this one and see if we can find why so many man-hours have gone into debating a rather foolish thing. Unlike the first riddle, this one is not necessarily a false problem, but it is a semantic rather than a scientific one. "Define 'sound,'" my father said when the problem was first put to him, "and then I can give you an opinion." If, he said, you define sound as the effects of a wave train on the eardrum and auditory nerve of a living organism then there is no sound if no living organism is close enough to the event to "hear" it. If, on the other hand, your definition of sound is simply the expansion and rarefaction of air in a wave train moving out from the event, then there is sound regardless of whether there are ears nearby to hear. It's that simple.

When you look at sound in the form of a phonograph record groove you see graphically the basic mathematical simplicity of sound. No matter how complex a set of simultaneous sounds may be, the resultant sound is conveyed and represented in a very simple way. There are only two dimensions involved: time and intensity. The general forword-moving direction of the groove represents time, and the "waviness" represents wave peaks and troughs.

All methods of representing or recording sound reflect this simple two-dimensional characteristic of sound. The record groove moves under the playback stylus at the same speed that it moved under the

cutting stylus, thus matching the elapsed time. And as the cutting stylus moved from side to side, making the groove wavy, so the playback stylus is thrown from side to side by the wavy groove, matching the variations in density.

In the sound track of a film, the film moves at constant speed (matching the pace of its birth in recording) and variations of transparency correspond to density variations in the sound waves recorded. Magnetic tape also moves forward (time) and the degree of magnetisation changes from point to point (intensity).

The shape of a tone

Any pure single tone causes a wave train in the air by alternately thickening and thinning it and sending it out at 1100 feet per second, which is the speed of sound. Graphically represented, it looks much like the groove of a record. Simple, regular undulations represent a tone of constant pitch and loudness. What does the graph (and the record groove) do, however, when two such tones are sounded simultaneously? The graph need not superimpose one set of waves on another (and the phonograph record cannot or it could not be played, since the stylus can follow only a single groove.) Rather a "resultant" wavy line or groove appears, which represents a combining of the two wave trains. This has the appearance of being a little less regular (indeed it looks slightly random, but at any point in time the stylus, in its excursion from side to side of the neutral position of the groove, is exactly where it should be to represent the combining of the two sounds.)

Even the simplest and purest tones we can ever hear show up graphically as quite complex, because of overtones, acoustical properties of the listening environment, etc.

Certain pure-sounding notes in the mid-range of a clarinet, for example, are enormously complex. Starting with the raw frequency of the vibrating reed which ideally would be represented by a simple sine-wave, we must superimpose the following wave-patterns, to name a few: a complex pattern representing agitation of the air from the player's breath not contributing to production of the prime tone by the reed, whole sets of overtones or harmonics inherent in the design of a clarinet, (and each one a line of waves to be figured into the resultant wave), some minor patterns peculiar to sound being produced by this *particular* clarinet; the accoustical properties of the room in which the clarinet is being played (this means whole sets of wave-lines, all figured into the end product.)

Thus we see some of the fantastic complexity of a single note from a single orchestral instrument.

Now imagine this complexity of the resultant groove for a one-hundred piece orchestra recorded simultaneously with a solo voice and a large choir and a pipe organ. When this recording is completed and

A dog's auditory nerves might be as good as a human's but Beethoven means nothing to a dog who can only respond to loudness.

pressed into a record it will be a long *single groove*—the result of thousands upon thousands of wavy lines and trillions upon quintillions of possible combinations.

Consider the awesome analytic ability of the computer we carry inside our skull: when the stylus moves with this single wavy line, the human brain can reconstruct not only the pitches and rhythms of this music with such keenness that a single instrument or voice off key by a few cycles per second could spoil the performance, not only the individuality of the solo human voice and the totality of a large orchestra, separating out the qualities of the sounds of various sections and outstanding instruments (including the pipe organ), but it can sense the acoustical properties of both the hall in which the recording was made and the room in which it is hearing the recording played!

And all we've dealt with so far is monophonic sound (from one source), heard monaurally (with one ear). The complexity added to our brain's computer feat by the fact that in stereophonic sound (which is what all real-life sound is) a sense of direction is added to everything else, is difficult to describe. Briefly, it entails the width of the human head, phase differences caused by the arrival of certain mid- and low-frequency wave troughs and crests at each ear at different times, a shadowing of one ear or the other by the head blocking high frequency wave fronts, and the interpretation of slightly differing sets of data coming to each ear from each of two or more directions, to produce an effect of depth similar to the illusion of distance brought about by the conflict of information between each eye in binocular vision.

Music starts in the mind

Bear in mind, nothing in the hi-fi set does this computer work. The speaker puts out a wave train of air exactly analagous to the wave train represented in the wavy groove. All the analytic work is done in the brain and on such deep levels that I suspect nothing in computer design to date could adequately account for the process. A possible implied comment on subjective truth: the idea of 'music' starts in the mind and ends in the mind. A dog's ear and auditory nerves might be as good as a human's but Beethoven may mean nothing to him. So far I've never seen a dog respond to anything but the loudness factor of music of any kind.

And here is the reappearance of the old philosophic question of whether the whole idea of extension

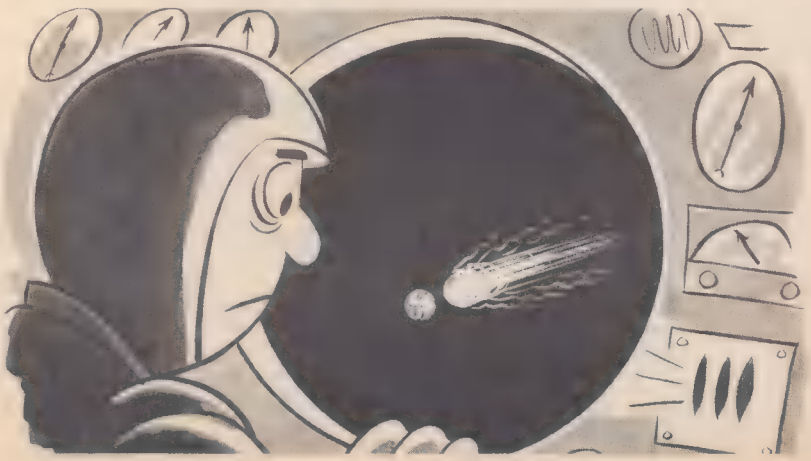
in space and duration in time is ultimately subjective: Binocular vision produces the illusion of depth and stereophonic sound, interpreted by the mind, helps produce the illusion of spacial width. Is all the world's reality a fabric spun only by the mind? The rest only mathematical symbols, from which are selectively garnered those which fit the needs of a soul seeking duration in time and extension in space?

An engineer once remarked to me that a certain recording was better than real. I reminded him that if the in-person sound is accepted as the definitive sound and a standard of perfection against which to measure any reproduction of it, there is no way to improve on it. Whereupon he showed me what happens to the human ear with age. The ends of the spectrum of sound begin to droop. That is, the ability of the ear to detect all frequencies with equal efficiency begins to slip. The extreme highs go first and then other frequencies.

In forming playback curves (which can be patterned to overcome deficiencies of playback equipment—to suppress surface noise of record materials, and limitations of groove-spacing, etc.,) limitations of the aging human ear can also be taken into account and certain flagging areas bolstered—given special pre-emphasis—to make up for the loss in natural hearing. The result of this is sound that has the characteristics of sound as we heard it when we were younger! This "nostalgia" factor can literally give reproduced sound the qualities sound had when we brought fresher, more sensitive ears to it.

Thus, in a very real sense it is better than its original.

"Well Charlie—how does it look from up there?"



How to find life on Mars

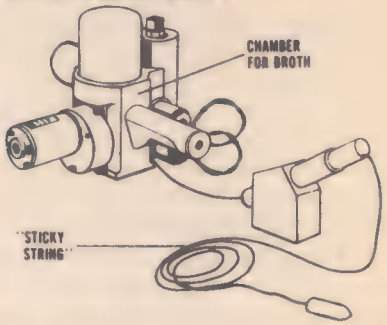
THE first life to be found on other planets will probably not be the BEMs (Bug Eyed Monsters) of science fiction, but tiny microorganisms.

Biologists recently made an urgent appeal to the National Aeronautics and Space Administration to include instruments capable of detecting extraterrestrial life on the earliest available Mars mission—in 1969.

At present NASA does not plan to send an Automated Biological Laboratory (ABL) to Mars until the early 1970s. But it does have some ABL devices under study at this time.

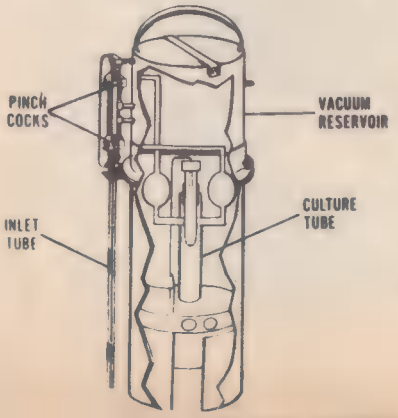
The three shown here all work on about the same principle. Samples of soil will be picked up and exposed to chemicals within the ABL. If microorganisms are present, they will grow or a chemical reaction will take place. In either case the action will be electronically sensed and signals sent to earth.

GULLIVER-MODEL MARK II



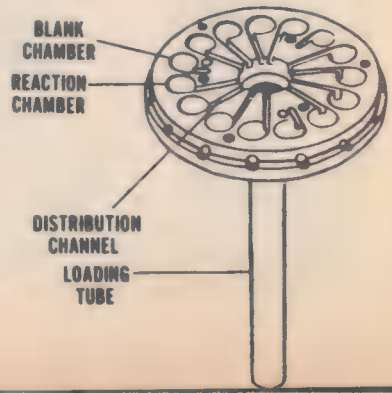
A bullet shoots out a sticky string. As it is reeled back, soil and microorganisms cling to the surface. The string is then drenched in a nutrient broth. If bacteria are present, they will grow in the broth.

WOLF TRAP



The inlet tube descends to the level of the ground, its tip shatters, and vacuum action draws up soil samples. The samples drop into the culture tubes, and if bacteria are present, they will grow in the culture.

THE MULTIVATOR



Dust is drawn up through the loading tube and blown into the reaction chambers containing chemicals that will react if life forms are present. The blank chamber is used as an experimental control.

Science in the news

American attitudes toward cancer are paradoxical. A report that a study had shown G.D. Searle's widely-used and highly-profitable birth control pill, Enovid, accelerated the growth of tumors in rats sent Searle's stock prices tumbling. This despite the fact that data on the three million women now taking the pill indicates that they are safe as far as cancer is concerned. If anything, the data show that the pills protect women from cancer.

Cancer might scare investors, but it can't scare smokers. Cigarette sales, which dropped sharply after the release of the Surgeon General's report, have climbed right back up to previous high levels. Other countries in the past had the same experience. Tobacco companies, however, reflected the general increased anxiety about smoking by bringing out at least six new cigarettes with "activated charcoal" filters. The value of such filters in keeping cancer-causing substances out of the lungs is unproved. Advertising highlighting charcoal filters made no direct claims but left the distinct impression that charcoal filters make cigarette smoking safer.

Virus-like particles have been linked to a type of cancer found in African children.

Science in the news

This is the fourth time within the last six months that an association between a virus and human cancer has been reported. We may get vaccines against some cancers but experts caution that their use may be limited and they will take a long time to develop.

Researchers at Cleveland Metropolitan General Hospital kept isolated rhesus monkey brains alive and presumably awake for as long as 18 hours. Along the same lines surgeons at the U. of Wisconsin kept severed dogs' heads alive for several hours. Outraged U.S. animal-lovers said the experiments were cruel since the isolated brains had no way of showing if they were in pain. Even the respected British publication New Scientist had reservations: "At what stage along this particular experimental road should we call a halt? . .There is an urgent need for biologists to evolve a policy to regulate such experiments."

Although the few diehard opponents of evolution probably won't be convinced, Darwin's theory received strong confirmation from biochemists at Carnegie Institution. They demonstrated that human DNA is in many ways identical to monkey DNA. It was not nearly as similar to mouse DNA, only distantly related to salmon DNA and very, very different from DNA taken from bacteria.

At a Virginia hospital, burn patients are being encased in germ-free plastic bags.

The American Heart Assn. recommended that Americans begin reducing the amount of fat they eat. . .Meanwhile researchers from Oklahoma have found that the residents of Roseto, Pa., mostly of Italian descent, who eat fat, are fat and happy, have a remarkably small number of heart attacks. The rate is one-quarter that of the surrounding towns. The suspected reason: Residents of Roseto seem to enjoy life more than most.

Population experts noted, with delight, that the U.S. birth rate is declining and has been for the last two and a half years. Why? Birth control pills were introduced about that time and there is a change in attitude toward family size.

There are some cool regions in the sun's corona--well, relatively cool. Pictures taken during last July's total eclipse revealed areas of about 20,000 degrees in the glowing region around the sun. The rest of the corona has a temperature of 3 million.

The U.S. got a very sticky scientific and diplomatic problem because someone at the Atomic Energy Commission forgot to throw a switch. Because of the error a transit navigation satellite failed to go into orbit and plunged earthward off the East Coast of Africa. The navigation satellite contained 2.2 pounds of very expensive, very lethal plutonium. The material hopefully is floating safely in the upper atmosphere.

The Saturn I rocket performed almost perfectly in a test when it placed a dummy verson of the Apollo lunar spacecraft into a low earth orbit. . .The Soviets may be building a Saturn-type booster for their own manned moon trip. Washington has evidence indicating that the Russians are not going to stop with their present powerful boosters. If the Soviets are trying to match the 1.5 million-pound-thrust Saturn it is a good guess they will use it to try and send men to the moon. .The Soviets also sent a probe (Zond I) toward Venus. It was over two months after the launching that they finally confirmed the probe was heading toward Venus. Aside from saying everything was working OK the Russians have been unusually close-mouthed about details.

Remember the antimissile missile? A decision on whether to go ahead or forget it has been put off again--until next year. What's the problem? The thing will cost $15 billion to construct and no one is really sure that it will work. The Administration hopes disarmament agreements will make such a weapon unnecessary in the future.

The nuclear rocket project Rover has solved some technical problems, but an economic one may keep it earthbound until the mid-1970s. Original target date was 1972. . . A promising small nuclear space engine, called Poodle, could gently push small payloads into space using power from the decay of radioactive polonium 210.

A report by the Institute of Defense Analysis for the Department of Defense found no scientific evidence that lie detector tests were worthwhile. The report was first submitted in 1962 but kept secret for two years. Despite the report the Pentagon kept using polygraphs until recently. The report also found persons could be trained to effectively fool lie detectors.

Were the Dead Sea Scrolls the work of anti-Roman revolutionaries rather than pre-Christian pacifists? Prof. Cecil Roth says scholars have been wrong in attibuting the scrolls to contemplative Essenes. He says they are the work of the "Sicarii (Daggermen) Zealots," extremist leaders of a Jewish revolt against Rome about 66-73 AD.

Needed: One great big 'brain' to store and make available information in all fields of science. This ambitious plan was proposed by former Kennedy assistant Dr. Stafford L. Warren. It is under study.

QUOTE OF THE MONTH AND YEAR: " I propose to dedicate this year to finding new techniques for making man's knowledge serve man's welfare. . .Let it be a turning point in the struggle--not of man against man, but of man against nature. In the midst of tension let us chart a course toward the possibilities of conquest which bypass the politics of the cold war."--PRESIDENT LYNDON B. JOHNSON

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Do a crystalography project illustrated with large beautiful crystals you grow yourself. Kit includes the book, "Crystals and Crystal Growing" and generous supply of the chemicals you need to grow large display crystals of potassium aluminum sulfate (clear), potassium chromium sulfate (purple), potassium sodium tartrate (clear), nickel sulfate hexahydrate (blue green) of heptahydrate (green), potassium ferricyanide (red), and copper acetate (blue green).

Stock No. 70,336-AD.....$9.50 Postpaid

MINIATURE WATER PUMP

Wonderful for experiments, miniature waterfalls, fountains, HO gage railroad backdrops, etc. Tiny (2⅝" 1⅜") electric motor and pump ideal for hobbyists, labs, schools. Pumps continuous flow of water at rate of one pint per minute at a 12" head. With 2 D Batteries in series will pump to 24" high. Runs 48 hrs. on battery. Works in either direction. Self-priming.

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SOLVE PROBLEMS! TELL FORTUNES! PLAY GAMES!

NEW WORKING MODEL DIGITAL COMPUTER

ACTUAL MINIATURE VERSION OF GIANT ELECTRONIC BRAINS

Fascinating new see-through model computer actually solves problems, teaches computer fundamentals. Adds, subtracts, multiplies, shifts, complements, carries, memorizes, counts, compares, sequences. Attractively colored, rigid plastic parts easily assembled. 12" x 3½" x 4¾". Incl. step-by-step assembly diagrams, 32-page instruction book covering operation, computer language (binary system), programming, problems and 15 experiments.

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7 x 50 MONOCULAR MAKES INEXPENSIVE, LIGHTWEIGHT TELEPHOTO SYSTEM FOR ANY CAMERA

Optimum in optical performance. Field of view at 1000 yards is 376 feet. Relative light efficiency is 75. Exit pupil measures 7mm. Has socket to attach to photographic tripod. Includes telephoto adapter which fits monocular eyecup—accepts the Series V adapter ring so can be used with any camera, especially reflex. Precision, Japanese made. Approx. 16-oz.

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ADAPTER RING ONLY, for adapting monocular to any camera.
Stock No. 40,680-AD.....$1.50 Postpaid

BUILD A SOLAR ENERGY FURNACE

A fascinating new field. Build your own Solar Furnace for experimentation—many practical uses. Easy! Inexpensive! Use scrapwood! We furnish instructions. This sun powered furnace will generate terrific heat—2000° to 3000°. Fuses enamel to metal. Sets paper aflame in seconds. Use our Fresnel Lens—11" Sq. F.L. 19"

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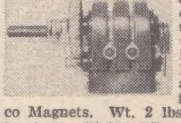
WAR SURPLUS ELECTRIC GENERATOR



Brand-new Signal Corps Generator for endless experiments, electrical users, demonstrations. Generates up to 90 volts by turning crank. Use in high impedance relays. Ring bells. Or charge ground and bring up night crawlers for fishing bait. Has 2 Alnico Magnets. Wt. 2 lbs. Cost to Govt. $15.00

Stock No. 50,225-AD.....$6.95 postpaid
Same type generator, mounted, with light, as electricity demonstrator.
Stock No. 50,365-AD.....$11.95 postpaid

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EDMUND SCIENTIFIC CO., BARRINGTON, N. J.

Air-conditioned suit

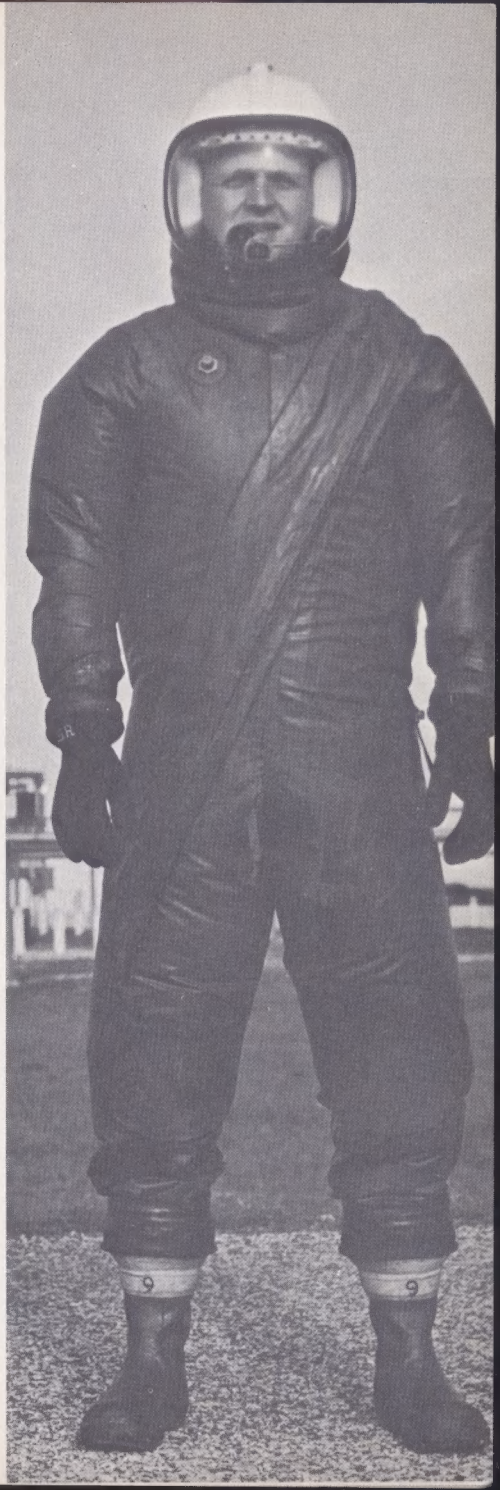
MANY of you undoubtedly own new miracle fabric summer suits that are supposed to keep you cool these muggy August days. Although it wouldn't do for everyday wear, the suit shown at the right would keep you a lot cooler—it's air conditioned.

Called a SCAPE suit (for Self-Contained Atmosphere Protective Ensemble) it's made, not for comfort, but for the safety of men who handle the transfer of liquid propellants for the Titan II rocket. Either spills or vapors from the propellant chemicals could cause death.

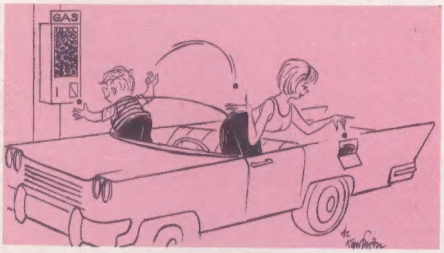
The chemicals that make up the propellant are hypergolic, that is, they burn on contact. This eliminates the need for complex, expensive ignition systems.

The fuel is Aerozine 50, a 50-50 mixture of two liquid rocket fuels. It is stable, can be stored at normal temperatures, is colorless and has an ammonia-fishy odor. The second propellant chemical is nitrogen tetroxide, the oxidizer. This chemical is also very stable at ordinary temperatures. It is a heavy, reddish-brown liquid with a sweet odor.

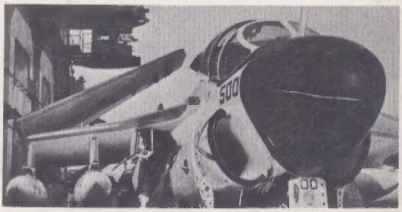
Despite the dangers in handling these chemicals, more than 20 Titan II's have been launched from Cape Kennedy without a single man-hour lost due to accident.



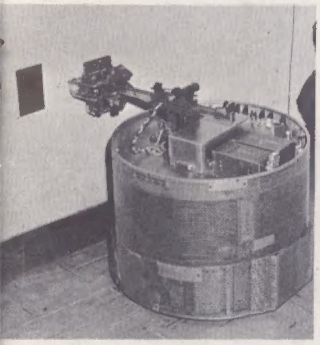
Also in this issue . . .



What's the truth about that rumor that the big oil companies are suppressing news of the invention of an inexpensive gas substitute? See page 63.



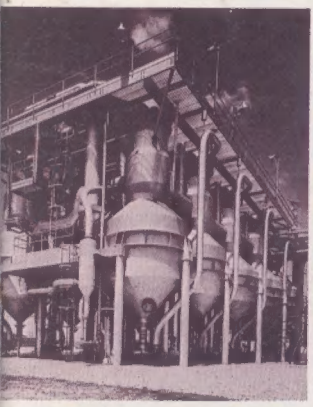
This jet will replace the reliable Skyraider, the last propeller-driven attack plane used on U.S. carriers. Story of today's carriers on page 32.

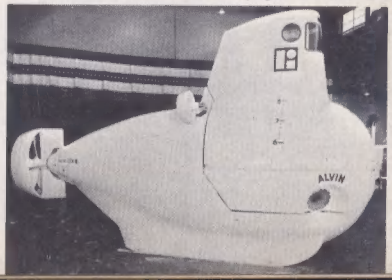


This hungry little machine is looking for a place to plug itself in and eat. The story of this odd robot begins on page 61.

Courtship is one of the most important and least understood periods of our lives. A report on two studies of courtship begins on page 68.

Two years ago the late Rachel Carson created a storm with her warnings about pesticides. Where does the problem stand today? Page 39.



The world faces an ever worsening water shortage. Large scale desalting of sea water is the only answer. A major proposal on how to make this process economical through the use of atomic power is presented in an article that begins on page 57.

New vessels, designed to explore the depths of the oceans, come in all sizes and shapes. Some of the most unusual are on pages 14 and 15.